WHY DO WE HAVE TO DO THIS FOR MONEY?
AN ECOLOGICAL INVESTIGATION OF REWARDS AND LEARNING

BY

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For my mother, Louise, who was my first and best teacher;

my husband, Jim, who has lovingly supported my education;

and my son, Jay, who gives meaning to all that I have learned.

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Behind every achievement exists the motivation which is at the foundation of it and which in turn is strengthened and nourished by the accomplishment of the undertaking. Here there is the greatest difference and it is of greatest importance to the educational value of the school.

-Albert Einstein

Out of My Later Years, 1950
The Philosophical Library, Inc.,
New York, N. Y.

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December 1982

Chairman: Dr. Lee J. Mullally
Major Department: Curriculum and Instruction

This study was based on an ecological approach to motivational research. Like other research in its tradition it focused on the influence of "extrinsic" rewards on "intrinsic" motivation and learning. The terms intrinsic and extrinsic are examined and redefined, however, in light of an ecological definition for motivation.

The study examined the influence of a contingent monetary reward on the learning process, skill development, social interactions, and attitudes of 40 seven- to ten-year-old boys learning to play a game of skill. The experiment employed an ecological laboratory design in which subjects were allowed a minimum of free choice in engaging, processing, and terminating the activity. Subjects were randomly paired and pairs were randomly assigned to four treatment conditions.

The treatment covered two sessions. During the first session, two groups (reward) were offered money for playing the game; two other groups (no-reward) were allowed to compete if they so desired, but were not offered money. During the second session, one of the reward groups had the offer of money withdrawn, while one of the no-reward groups had the offer of money introduced. The data were analyzed by means of a 2 × 4 split plot ANOVA to determine whether reinforcement for competition produced differences among the groups on twenty-two dependent measures and whether the degree and direction of the differences changed when the reward was introduced or withdrawn during the second session.

Results indicated that reinforcement for competition significantly increased the amount of competitive play, reduced the amount of time subjects spent practicing, and reduced overall game-engaged time. Subjects who had been rewarded at any time for competition also spent significantly less time engaged in playing the game during a postexperimental free-choice period a week later. There were no significant differences among the groups on measures of skill development. Two measures of social interactions were significant, but differences ran contrary to predictions: No-reward subjects were more boastful and made more references to cheating while playing the game. Descriptive data are presented in the author's discussion and interpretation of these results.

CHAPTER I

STATEMENT OF THE PROBLEM AND CONCEPTUAL FRAMEWORK FOR THE STUDY

Problem Statement

The present study was designed to investigate how an externally controlled source of reward would affect learning process, skill development, social interactions, and attitudes of children toward a learning activity. The effect of an extrinsic reinforcer was examined in four different, but related, learning conditions. All of the conditions were designed to insure high intrinsic motivation for the activity and to be representative of real world learning environments. In three of the situations subjects were allowed to compete, at various time, for an extrinsic reinforcer. The question of interest was whether this reward, and the ensuing competition for it, would alter subjects' learning processes, skill development, cooperative behavior, and attitudes toward the activity.

Justification for the Study

Most children come to their first school experience with enthusiasm. They are eager for exploration and they

approach learning situations with determination and diligence. It is not unusual to hear them say they "love" school. Moreover, children have already mastered many psychomotor and cognitive skills. They have learned to walk, ride bicycles, play a variety of games, and communicate rather skillfully in one or more languages. And they have developed these proficiencies often without the benefit of any formal instruction. How to maintain their enthusiasm and motivate children to learn at increasingly complex levels has been a perennial educational concern. The present study addressed this fundamental educational question: How can schools best take advantage of children's natural enthusiasm and motivation to learn while helping them develop the skills they need to deal with the demands of their world?

Various approaches for enhancing student motivation in schools have been tried. Prevalent among these has been the use of incentives--in the form of course grades, points on examinations, or tokens. Such incentives have, indeed, proven effective for inducing children to do much of what is required of them in schools. Teachers have successfully used incentives to encourage children to read more books, write longer compositions, solve more math problems, and expand their vocabularies. Behavioral problems and absenteeism have also been remedied by the careful application of reward systems. Because of their success, reward

systems have become so commonplace in schools that it is difficult to imagine a school functioning, or children learning, without them.

But the truth of the matter is that children do learn without the aid of externally controlled reward systems. Outside the school setting, children learn efficiently and rapidly those things which are important to their growth and development. They do so without any formal curricular or instructional plan, without the help of trained teachers, and without any artificial inducements. For example, children acquire language at a very early age. Incoherent babblings gradually become shaped, through listening and experimenting, into articulate sounds. Those sounds grow into words and words grow into sentences. By the time children go to school, they are able to use language to tell stories, recount experiences, question, explain, and build convincing arguments. Of all the skills which children develop in their first five years, perhaps in their entire lifetimes, language is probably the most complex. Yet it is universally mastered.

Why is this? Why do children seem to have less trouble mastering the complexities of language than they have learning the names of the fifty states, or the multiplication tables, or the anatomical parts of a frog? Why does the mother feel no need to give grades or promise token

rewards while the school teacher does? It is not because the skills developed outside schools are easier to master or characteristically different from the skills taught in schools. It is because motivational aspects of the environments in which the learning takes place are different.

In the world, babies learn to talk as a result of environmental demands. Talking allows them to tell people how they feel, to ask for things they want, to understand and communicate with other people. Talking allows or "affords" something which being silent, or even babbling, does not. The act of talking and the consequence(s) of talking are structurally linked. Hence, the meaning of talking in the world is clear to the child. In the school environment, however, the meaning of what is to be learned is not so clear. Children learn the names of the fifty states, for example, because they are told it is important, not because its importance is readily apparent to them. This is not to say that learning the names of the states does not afford something. Certainly, these names afford children a better understanding of their nation and an improved ability to communicate and learn about that nation. But this affordance is not readily perceived. Children do not see how learning these names will allow them to do things which they want to do and cannot do already. If they fail to learn these names, children

feel no personal discomfort, no sense of loss, no frustration. The school environment provides no structural link between the act of learning the names of the states and the consequence(s) of that act. Therefore, schools have found it useful to impose artificial consequences in the form of rewards and punishments.

Questions about the utility of such rewards have been raised by certain motivational research which indicates that the use of artificial inducements may have undesirable effects. This research is based upon the theory that human motivation has, at least, two dimensions. Along one dimension, our behavior can be motivated by external factors such as environmental rewards and punishments. Along the other dimension, it can be motivated by factors which inhere in the individual and/or his behavior. These dimensions have been called, respectively, extrinsic and intrinsic motivation. Studies in this field have shown that extrinsics, while increasing the frequency of reinforced responses, can have a negative effect when used to motivate behavior that would otherwise be freely chosen. A popular way of stating this relationship is to say that extrinsic rewards tend to undermine intrinsic motivation. The effect appears to be most pronounced when receipt of a material reward is made contingent upon performance of an already interesting activity. Findings have been relatively

consistent across age levels, types and magnitudes of reward, task requirements, and procedures. Even more important from an educational perspective, extrinsic rewards have been found to interfere with problem solving, creativity, insight, and other processes considered critical to learning. This research is reviewed in detail in Chapter II.

The present study represents a further attempt to document the influence of extrinsic rewards on intrinsic motivation and learning. The primary aim of this study was to test the influence of an extrinsic reward in a setting where learning could be expected to occur in response to other demands. These other demands will be called ecological rewards and their importance will be made clear as the theoretical framework for this research is described.

An Ecological Framework for the Study of Motivation

The Ecological Tradition

The impetus for the present study owes greatly to the pioneering efforts of James Gibson (1979), who established an ecological foundation for the study of visual perception. Gibson's work was committed to the principle of direct, rather than mediated experience. The organism and the

environment constitute a system, he said, in which the smallest unit of ecological analysis must be a dynamic event, rather than a static stimulus, and in which the behavior of the organism is viewed as a process of adaptation to his experience of these events. How the organism adapts will depend upon the "ecological information" available in the ambient flux of stimulation, and upon the pick-up of this information by the organism. Information is considered "ecological" if it specifies nontrivial properties which facilitate achievement or maintenance of an adaptive relationship with the environment (Shaw et al., 1974). Another way of stating this is to say that ecological inforamtion specifies what things "afford" the organism as he interacts with his surroundings. Thus, what one perceives are not meaningless characteristics of things, but, rather, what things afford in a particular behavioral/environmental context. The ecological study of human perception, then, is the study of a particular aspect of "organism/environment mutuality" (Alley and Shaw, 1981, p. 140).

The application of Gibson's ideas to the field of motivational psychology awaited the discernment of John Condry (1977), who first characterized task-extrinsic incentives as bits of ecological information which specify a particular motivational context. This

conceptualization has guided a research program at Cornell University, and is summarized in an article by Condry and Chambers (1978) as follows:

> We do not think of rewards as "undermining" interest or intrinsic motivation, although we recognize the popular usage of this term. Talking in this way, however, directs our thinking and theorizing; it suggests that there is an ongoing stream of intrinsically motivated behavior that is somehow "undermined" by the offer of a task-extrinsic incentive. In our research, we have conceptualized these facts differently. We have assumed that rather than undermine anything, the offer of a reward acted as a "signal" to the individual to call forth a given sequence of activity. Thus, task-extrinsic rewards are part of an informational array specifying the appropriate actions to take and perhaps the appropriate way to conceptualize the "causes"of one's behavior. The absence of a reward as well as other aspects of the situation are part of an informatinal array we call a "context," which elicits a different pattern of motivated behavior. . . . Thinking about it in this way has some advantages:
>
> 1. It takes our attention away from the reward "per se" and focuses it on the entire complex of information facing the individual. . . .
>
> 2. It avoids the conception of motivation as being either "intrinsic" or "extrinsic." Rather, we think the information specifying these different contexts and what they "afford," what they offer, exists and is discriminated by individuals. This discrimination is reflected in both behavior and conceptualization. . . . Thus, we avoid a false dichotomy (not a false distinction) and leave open the question of whether there are other informational arrays, other "contexts" that give rise to other patterns of motivated behavior. . . . (1978, p. 62)

What Condry and Chambers offer here is an orientation to motivational theory which centers on the fact of

organism/environment mutuality. This orientation avoids the implication that extrinsics are either good or bad. It also forces one to consider the effect of rewards relative to the context in which they occur, rather than as dichotomous catalysts with opposite and absolute powers to influence behavior.

An Ecological Definition of Motivation

When motivation is viewed ecologically, it becomes difficult to reduce the influence of rewards to a specific effect. This view also makes the terms intrinsic and extrinsic difficult to interpret. Just as the presence or absence of extrinsic rewards changes the motivational context, so other information in the context may alter the significance of such rewards. It is likely that certain activities, especially those which require complex and prolonged learning, depend for their mastery upon incentives which are extrinsic to actual task demands but are intrinsic in the sense that they provide important feedback regarding an individual's progress. Such "extrinsic" incentives may actually increase "intrinsic" motivation. Take, for example, the case of a dancer who works harder in order to hear louder applause from the audience, or demands a high salary, or strives for recognition as the premier dancer of the company. Such incentives are clearly extrinsic, in that they do

not inhere in the act of dancing. It is unlikely, however, that any of these rewards would have the effect of undermining intrinsic motivation for dancing, i.e., they would not diminish interest or reduce willingness to dance. In fact, we would expect them to have just the opposite effect.

As Condry and Chambers observe, it is at this point that the dichotomous terms "intrinsic" and "extrinsic" become troublesome. Typically, extrinsically motivated behavior refers to behavior elicited by reinforcement outside or external to actual task demands. Intrinsically motivated behavior is that which the individual selects due to inherently reinforcing properties of the behavior. As used here, intrinsic seems to signify that the behavior and the consequence of the behavior are inseparable, i.e., that the behavior is its own reward. This cannot be the case. For any activity, even an apparent nonactivity like resting, there is a consequence; and it is the consequence of the act, not the act itself, which is the "intrinsic" reinforcer.

A more precise terminology has been put forth by Bengston (1981). He suggests that we characterize rewards as either "ecological," in the sense that they issue from and are structurally linked to activity, or as "contrived" in the sense of being imposed as a function of forces

independent of the activity. An ecological reward, then, is part of the fabric of experience. Its affordance issues from the context of behavior and "its value or worth does not depend upon a controller embedding it within events that would not otherwise obtain" (Bengston, p. 2). The ecological reward, being a consequence of an act, specifies an event. The contrived reward, on the other hand, is only arbitrarily related to an act. Therefore, its affordance is unrelated to the demands of activity. Because it is dispensed by a controller outside the activity, it specifies only that the rule of dispensation has been met. Whatever value it may have, or whatever power it may demonstrate for controlling behavior, there is always the danger that the contrived reward will divert attention from ecological consequences of behavior.

For educators, the uncritical application of the term intrinsic motivation is dangerous, because it allows us to isolate motivation for learning within the learner. We may too easily excuse poor instruction and failing student work by claiming that the learner just was not interested or motivated. We may resort to "making people feel good without regard for the quality of the relationships between learners and their natural and cultural worlds" (Bengston, p. 3). We may become so preoccupied with making learning fun that we neglect to consider, much less reveal for the

learner, the larger importance of what is learned. Such a situation would scarcely improve upon the view that all learning is the result of external forces which can be (indeed, must be) controlled by the assiduous structuring of contingent reinforcement schedules.

In the interest of precision, the present investigation will employ the terms "ecological" and "contrived" to replace their more popular counterparts. The terms "intrinsic" and "extrinsic" will be used only in discussing previous research.

The Concept of Competence and Some Other Assumptions About Learning

In 1959, Robert W. White introduced into motivational theory what he called "the concept of competence." The purpose of this paper was to reconceptualize motivation to account for certain phenomena which drive theory had failed to explain. In developing his thesis, White defined "competence" as "an organism's capacity to interact effectively with its environment," (p. 43) and he argued compellingly for the idea that all animals strive continuously toward this goal. In human beings, competence develops through prolonged and extensive cycles of learning. The cumulative learning which begins at birth and increases in complexity and efficiency throughout life is motivated

by the adaptive utility of becoming more skilled, more capable, i.e., more competent in dealing with one's world.

The concept of competence entails three basic assumptions. First, learning differs in important ways from skilled performance. Therefore, what may be appropriate means for motivating the one, may be inappropriate for the other. Second, all learning is environmental and adaptive with environmental demands. Finally, learning is cyclical. The learning cycle represents a process of learner/environment adaptations, and, therefore, the nature of the cycle will depend upon the nature of the learner/environment relationship. Each of these assumptions is described in detail.

Process Versus Performance

The first assumption of the present study is that the process of acquiring skill differs in important ways from skilled responding. Research has established rather clearly that the offer of a reward for the performance of well-learned skills actually facilitates that performance. In an excellent review of studies which have shown a facilitative effect of rewards, McGraw (1978) observes that such studies may, in reality, have been measuring skilled responding, and not learning. These studies have typically measured rate and accuracy of responses on tasks such as mental multiplication, serial learning, pair-association

learning and perceptual recognition. McGraw notes that facilitation seems to occur only on problems for which the person has a solution prior to beginning the task. Therefore, what is being measured in these studies may not be learning, but the speed and accuracy with which one is able to apply a familiar algorithm. Bear in mind that the question being investigated in this study pertains to the influence of rewards on the acquisition of new skills as the individual strives to develop competence with a learning activity.

Learning Environments

The second assumption of this study is that learning occurs within an environment and is, therefore, shaped by environmental demands. The term "environment" refers to those aspects of the world with which a person interacts. While two people may reside in the same area of the world, they may interact with different aspects of the world, depending upon the environment or niche which they inhabit. The Aussie and the Aborigine both reside in Australia. But the former occupies the civilized shoreline of the continent, while the latter lives in the wild and barren interior. Therefore, to say that one is an Aborigine or an Aussie is to say something about the environment that person inhabits and the demands with which he has adapted. All environments are "learning environments," in the sense

that they require some form of individual adaptation. In this paper, however, the term "learning environment" is used specifically to refer to a context of events designed to facilitate psychological adaptation, i.e., learning.

In the world, learning often occurs rather efficiently in the absence of any formal instruction. There seems to be no motivational problem. Skills which are important are learned within the context to which they are relevant and, moreover, they are learned to mastery. In ecological terms, these things are so because, in the world, the act of learning and the consequence of learning are structurally linked. This linkage is maintained by the influence of three principles. First, there is information in the environment to "engage" and direct the learner's attention toward important aspects of the total informational array. Second, there is "coherence" within events, and one can perceive that coherence. Finally, there is "responsiveness" of environmental information. That is, feedback is provided within events to specify progress and completion of activity, so that the learner knows how well he or she is doing. Consider how engagement, coherence, and responsiveness control learning in two real world learning environments.

First, consider the case of a boy in a tribal culture as he learns to hunt. As the boy grows to manhood, he is increasingly aware of the importance of skilled hunting to

the survival of his tribe. He watches and models the behavior of the men as they prepare for and celebrate the hunt. They reveal its importance by taking pride in their own skill. Thus, the boy's attention is engaged toward developing his own skill as a hunter. When he goes on his first hunt, his father and the bush are his teachers, responding promptly and informatively to his mistakes, as well as to his successes. From his mistakes, he learns the importance of precision and concentration. Each success increases his confidence and paves the way for more challenging adventure. Events and his perception of those events cohere perfectly because his acts are structurally linked to consequences. If they were not, he would not master the skill of hunting. If he did not become skillful, he might be killed by his prey, or his family might starve.

Next consider the example of a boy in urban society learning to drive a car. This task has engaged his attention since childhood. He knows that being able to drive gives adults independence which he does not have. As he sits behind the wheel of a parked car and models his father's behavior, he feels very grown-up and powerful. When the time comes for him to take the car out on the road, his parents and the city streets teach him. His mistakes are embarrassing, sometimes costly. But he learns

from them, because the coherence between his behavior and the consequences of his behavior is clear. As the basics of maneuvering the car and avoiding collision become routine, his skill is challenged by new highways and longer distances. His world grows larger and, as it does, his skill as a driver steadily improves through practice and experience. His life and the lives of others depend upon this.

Motivation is not a problem in either of these learning situations because learning occurs within the context to which it is relevant (Condry, 1978). The principles of coherence, responsiveness, and engagement control the learning because of the structural linkage between acts and their consequences. The desire, the need, the willingness to learn grows out of the individual's striving to adapt with the demands of the environment he occupies. When learning is decontextualized, however, environmental coherence, responsiveness, and engagement may be missing or concealed, and stimulating the willingness to learn becomes problematic. If one doubts this, he might consider the motivational problem inherent in teaching the urban dweller to snare the tiger, or the primitive to master a driver's manual. One way to solve this problem is to resort to the use of contrived incentives.

Contrived incentives used in place of environmental or ecological incentives may succeed in stimulating activity. They may engage attention toward their attainment. They may induce an artificial coherence in which the consequence of acting becomes the receipt of a valued reward. As long as activity leads to the reinforcer, activity will continue. Contrived rewards may also take the place of environmental responsiveness, providing feedback as to the correctness of activity. But, when contrived incentives control learning, there may also be other outcomes. Because the contrived reinforcer has been the purpose for activity, once it is removed, the rate of the reinforced response is likely to drop; perhaps below the baseline level. Moreover, the learning which results from the control of contrived reinforcers will depend almost entirely upon the performance contingencies which are established. There will be no press to learn unrewarded responses; therefore, incidental learning or integration of learning is unlikely (unless contingencies are also established for these). So it is that contrived rewards may control the learning environment, but not without undesirable effects.

Learning Cycles

The final assumption of the present study is that learning is cyclical. Even the simplest act, like

lifting food to the mouth, depends for its mastery upon prior learning and, in turn, opens new vistas to higher learning. The process entails a cycle of perceptions, adaptations, and renewed perceptions. Reduced to its essential components, the learning cycle has four stages which have been labeled by Condry and Chambers (1978) engagement, process, disengagement, and reengagement. Engagement refers to an individual's approach to a task; the why, where, and how of his initial undertaking of a learning activity. Process refers to the methods or strategies used by an individual in acquiring a new skill or concept; his patterns of attention and integration of information, his use of time, and so forth. Disengagement refers to an individual's termination of activity; the when, why, and how of his willingness to leave the task. Reengagement refers to an individual's return to a task once it has been terminated; his willingness to reapporach a completed activity (as in the case of puzzles which allow varied solutions), or his willingness to persist in an uncompleted activity (as in the case of skills which require a number of cycles or repeated practice for mastery).

How the person moves through this cycle will depend upon features of the learning environment; the coherence of events, the responsiveness of feedback mechanisms, and

to what extent (and in what direction) attention is engaged. The concern of this investigation is how the cycle will differ, depending upon whether ecological rewards or contrived rewards are in control. The more salient a reward, the more control it is able to exercise. Consider how the cycle of learning mathematics might differ depending upon whether ecological rewards or contrived rewards were the more salient features of the learning context.

The assumption of this study is that when ecological rewards are in control of the learning cycle, attention is focused upon those events which seem most likely to afford growth toward competence, i.e., mastery. If one's attention were engaged, perhaps by a desire to understand Einstein's theories, toward the task of mastering higher mathematics, it would profit one to work mathematical problems. The difficulty level of the problems engaged would be determined by one's knowledge of his present level of competence and the development afforded by the problems. Working only problems that could be solved easily would not serve one's purpose of mastery, that is, it would not get him closer to his goal of understanding higher mathematics.

Now, suppose a person were paid to learn math. In this case, learning would be motivated by profit. Moreover, learning would be controlled by whatever performance

contingencies were established. These contingencies would have to be observable or measurable, so it is not unlikely that the receipt of payment might be made contingent upon a number of math problems completed in a specified time. A learning environment would then be created in which the consequence of doing math problems was no longer the learning of mathematics, but the receipt of payment. Math problems would be engaged, not for what they afforded to the task of doing higher mathematics, but for what they afforded to receiving the payoff. Reason would suggest that the difficulty level of math problems attempted under this condition would be dictated by the ease with which they could be executed. To do time consuming problems, to explore various solutions to the same problem, or to attempt problems which were obviously too difficult (but which looked interesting) would all be contrary to the profit motive. Research which supports this logic is reviewed in Chapter II.

The actual process of solving problems, under the control of a contrived reward, would probably become solution, rather than development, oriented. There is evidence to suggest, also, that solutions would become stereotyped; that is, solutions which had worked in the past would be tried over and over again (Schwartz, 1982). Because of the narrowed attention of the goal-directed

learner, he or she would be prone to miss or ignore important information. Thus efficiency would be reduced and fewer problems might be solved. Frustration would be likely to increase. Depending upon how highly the learner valued the goal and upon the means available, shortcuts, deceptions, or fabrication of solutions might be tried. Of course, the learner might choose to ignore the contrived reward; to make learning mathematics more important than getting the payoff. In this case, however, the learner would be operating under a different set of perceptions than the one dictated by the context. Control would have been returned to ecological rewards. If the contrived reward were salient and highly valued, however, it is more likely that the learner would adapt to its demands. In this case, failing to use any means available to complete problems would be counteradaptive.

Disengagement of the learning activity controlled by contrived rewards would occur, not because curiosity had been satisfied, or because a sense of mastery had been achieved, but because the reward had been secured. Moreover, the willingness to reengage the activity in the absence of the contrived reward would be reduced. There is substantial research, detailed in Chapter II, that supports this claim. Why this is the case is still a matter for speculation, however. It may be that one who

engages a task for the purpose of securing a contrived reward comes to believe that the task has no inherent value. That is, the mere offer of a reward may signal to the person that the task is not worth doing in its own right. A more tenable explanation is that the contrived reward reduces willingness to reengage an activity because it focuses attention upon itself, rather than upon ecological rewards to be derived from the activity.

Outline of the Present Research

General Hypotheses of the Study

Two general hypotheses guided the study. The first of these related to the presence or absence of a contrived reward in a learning environment where ecological rewards were already in place. This hypothesis might be formally stated as follows: The introduction of a contrived reward into a learning context where ecological rewards are salient will negatively affect learning process, skill development, social interactions, attitudes, and subsequent motivation for the activity.

The second general hypothesis grew out of a desire to know whether the timing of a contrived reward might alter its influence. Typically, studies in this field have introduced the contingent reinforcer as a condition of initial engagement, allowing it to stay in place throughout

the learning cycle. This study attempted to determine whether the effect of a contrived reward might change if the reward were introduced after the activity had been engaged under ecological conditions. Likewise, it seemed important to test what effect withdrawing the reward would have on the behavior of subjects who had engaged the activity under contrived conditions. The second general hypothesis might be formally stated as follows: The degree and direction of a contrived reward's influence will change depending upon the time of its introduction into the learning cycle.

Experimental Conditions

The ecological thrust of the present study dictated that the experimental setting incorporate demand characteristics of real world learning. To this end, an ecological learning context was created, i.e., a context in which learning could be expected to occur in response to ecological demands. This basic context was then altered in three ways, creating four experimental conditions. The distinguishing characteristics of these conditions were the presence or absence of a contrived reward and the time at which this reward was introduced into the learning cycle. In three of the conditions, receipt of a monetary reward was made contingent upon competition with a partner. While all subjects participated in two experimental

sessions, subjects in two of the three reward conditions were offered the reward at only one of these sessions.

In all four conditions, pairs of children played a maze game called Labyrinth, which has three playing boards that require different levels of psychomotor skill. In order to disguise the fact that their learning was the focus of the study, children were told that they were helping the experimenter conduct an evaluation of the game. A general description of the four experimental conditions follows:

No-reward/No-reward (NN). Subjects in this condition received no monetary reward at either of the two experimental sessions. They played the game in the same room and were advised that they could play competitively. They were also supplied with a score sheet on which they could tally their wins. This group engaged, processed, and disengaged the learning activity under ecological conditions.

No-reward/Reward (NR). Subjects in this group were offered a monetary reward for winning matches on the second day, but not on the first day. Thus the learning activity was engaged under ecological conditions, but was reengaged under contrived conditions. This experimental condition simulates the real world practice of rewarding achievement after some skill has developed, in the hope

that this will also inspire greater achievement. The degree/diploma system in our schools operates in this way.

Reward/Reward (RR). These subjects were offered the monetary reward at both sessions. Therefore, their engagement and processing of the activity was totally under the influence of the contrived reinforcer.

Reward/No-reward (RN). Subjects in this group were offered monetary reward on the first day, but not on the second day. Here, initial engagement took place under contrived conditions, but the activity was reengaged under ecological conditions. This simulates the common practice of offering people a contrived reward and then withdrawing it after a certain time, hoping that the rewarded response will maintain itself. Reading is frequently taught in this way; particularly in the primary grades, where children are awarded tokens or special privileges for completing reading assignements.

Research Questions and Specific Hypotheses

The specific hypotheses are now presented according to major areas of interest. For each area of interest, the general research question is presented, followed by the specific hypotheses which addressed that question. The hypotheses are expressed in terms of no-reward (N) groups, and the reader is asked to bear in mind that interactions were anticipated among conditions when the reward was introduced or withdrawn.

Research question 1--Learning process. The research question was whether or not the learning process of subjects in the ecological conditions would differ significantly from that of subjects in the contrived conditions. It was anticipated that subjects who were not offered the contrived reward would be more oriented toward the process of learning, while subjects who were offered the reward would be more oriented toward product, i.e., getting the payoff. The following hypotheses describe how these different orientations were expected to manifest themselves:

Hypothesis 1. N subjects will spend less time playing matches, i.e., competing.

Hypothesis 2. N subjects will spend more time practicing before playing the first match of the session.

Hypothesis 3. N subjects will spend more of their total session time engaged in playing their own game.

Hypothesis 4. N subjects will use more difficult boards during play.

Hypothesis 5. N subjects will be less likely to employ "minimax" strategies, i.e., strategies designed to minimize effort or competition in order to maximize scores (e.g., shortcutting through the game mazes, falsifying scores, or making rules which negate competition).

Research question 2--Social interactions. The research question was whether the presence or absence of a contrived reinforcer would change patterns of cooperative and

competitive behavior. It was anticipated that subjects who were not rewarded for competing would be more cooperative, or, at least, more likely to display an attitude of "friendly" competition than subjects who were given money for each match they won. The following hypotheses describe how cooperative versus competitive orientations were expected to manifest themselves in the behavior and attitudes of the subjects:

Hypothesis 6. N subjects will be more likely to share information, give advice or offer instruction to their partners with the intention of improving the partner's ability to play the game.

Hypothesis 7. N subjects will be more likely to praise their partners during play.

Hypothesis 8. N subjects will be more likely to offer encouragement to their partners during play.

Hypothesis 9. N subjects will be less likely to interfere, annoy, or distract their partners with the intention of disrupting their play.

Hypothesis 10. N subjects will be less boastful during play.

Hypothesis 11. N subjects will have fewer arguments.

Hypothesis 12. N subjects will be less likely to talk about cheating.

Hypothesis 13. N subjects will be less likely to cheat their partners.

Hypothesis 14. N subjects will rate their experience with the game as less frustrating.

Research question 3--Skill development. The research question was whether subjects who had worked through all or part of the learning cycle under ecological conditions would learn as much about playing the game as subjects who had worked for the contrived reward. It was anticipated that subjects who played the game under ecological conditions would develop more skill and a better knowledge of their own competence, because their attention during the learning cycle would be focused primarily upon features of the game which afforded mastery, rather than upon features which afforded getting the payoff. These predictions followed from those set forth in reference to the learning process and were expected to manifest themselves in the following ways:

Hypothesis 15. N subjects will develop more skill with the game.

Hypothesis 16. N subjects will develop better knowledge of their own competence with the game.

Hypothesis 17. N subjects will rate the game as being less difficult.

Hypothesis 18. N subjects will be more likely to express success at playing the game in terms of skill requirements.

Hypothesis 19. N subjects will be more likely to make internal attributions for winning or losing matches; i.e., they will be more likely to attribute wins or losses to their own effort or practice than to luck or game difficulty.

Research question 4--Interest. The research question was whether subjects in the ecological conditions would like the game as much as subjects in the contrived conditions. It was anticipated that subjects who had not been given any artificial inducement for playing the game would say they liked it better and would be more likely to reengage the game during a free-choice period a week later. It was further anticipated that subjects who had elected to compete in the ecological conditions would place less emphasis on the competitive affordance of the game than subjects who had competed for the contrived reward. The following hypotheses describe how these differing interest levels were expected to manifest themselves.

Hypothesis 20. N subjects will say that they like the game better.

Hypothesis 21. N subjects will place less emphasis on competition and winning as measures of game enjoyment.

Hypothesis 22. N subjects will be more likely to reengage the game during a postexperimental free-choice period; i.e., when there is no external pressure to do so.

Summary

This first chapter has described the nature of ecological research in the field of motivation. It has also outlined some assumptions about learning which are basic to an ecological perspective. Specifically, it has been suggested that learning outside the formal school setting does not depend upon externally controlled reinforcers, but upon rewards which inhere within the context of activity. The researcher has chosen to call these inherent rewards "ecological" rewards and has shown that, when they are in place, motivation for learning is not a problem. The externally controlled reward has been renamed "contrived"; and it has been suggested that the contrived reward alters environmental coherence, responsiveness, and engagement, thus changing the learning process. A review of research which lends support to this conceptualization of rewards is presented in Chapter II.

CHAPTER II

A REVIEW OF RELATED LITERATURE

Introduction

In 1974, Levine and Fasnacht reviewd a considerable body of research on the use of extrinsic rewards for motivating learning. The title of their review, "Token Rewards May Lead to Token Learning," suggests what they found; specifically, that short-term gains from token economies are offset by deleterious long-term consequences. Since the appearance of this article, evidence has continued to support this claim. In general, the evidence suggests that rewards which are contrived or extrinsic to task demands, anticipated by the learner before engaging a task, and delivered contingent upon performance of the task have a detrimental effect on the learner's interest and the quality of his performance. In addition, a recent line of research indicates that rewards may actually alter patterns of learner/task interactions during the learning process. What follows is a selective review of the literature bearing upon these points.

The Effect of Rewards on Interest

Experiments conducted by Harolw (1950; Harlow, Harlow, and Meyer, 1950) provided early insight into the effect of

extrinsic rewards on intrinsic motivation. Harlow et al. allowed rhesus monkeys to play with a latch-puzzle that could be opened by following a set of prescribed steps. The monkeys found the puzzle interesting and soon learned its solution. Some of these monkeys were then food-deprived for 22 hours, and the puzzle, baited with food, was returned to them. These monkeys displayed erratic behavior--"attacking" the puzzle, rather than confidently applying the manipulations that they had previously mastered. Moreover, once the puzzle was opened and the food eaten, the monkeys showed no further interest in it.

Like much infrahuman research, Harlow's experiment was regarded with skepticism. Some doubted that the findings would generalize to human behavior. Moreover, there were several competing explanations for the monkey's poor performance and reduced interest, such as fatigue, satiation, increased arousal, competing drives, and shifts in causal attributions (Bates, 1979). Harlow's research had, nonetheless, raised significant questions about the effect of extrinsic incentives upon performance and interest.

Deci (1971, 1972b) set out to document this same behavior pattern in human subjects. Looking at the problem from the perspective of self-perceptions theory (Bem, 1970), Deci predicted that subjects paid to perform an intrinsically rewarding task would experience a subsequent decline of intrinsic motivation due to a shift in their perceived

"locus of causality" for doing the task. That is, they would attribute the cause of their participation to the reward, rather than to their own interest or desire. Deci tested his hypothesis in two experiments using the SOMA puzzle, a commercial puzzle composed of pieces which fit together to form a variety of configurations. Subjects were asked to reproduce a number of patterns using the puzzle and received either (1) monetary reward, (2) verbal reward, (3) no reward, or (4) various combinations of these conditions. In both experiments, Deci's prediction was confirmed. The offer of money, a reward extrinsic to the demands of the task, tended to decrease intrinsic motivation (as measured by the amount of time subjects spent playing with the puzzle during a postexperimental free-choice period). On the other hand, Deci found verbal reinforcement, which is also considered an extrinsic reward, to have the effect of increasing intrinsic motivation in varying degrees. More will be said later regarding research on social rewards.

While Deci's research confirmed the possible deleterious effects of rewards on intrinsic motivation, it failed to address the issue of skill development. One might argue that a little interest is expendable in light of the tremendous power rewards have demonstrated for motivating performance, especially on boring or repetitive activities or in cases where individuals are decidedly "unmotivated."

Indeed, this line of reasoning led early researchers to urge cautious application of their findings.

The Effects of Rewards on Performance Quality

A study by Kruglanski, Friedman, and Zeevi (1971) opened an avenue of research which offered rebuttal to the above argument. Reasoning that "liking" or interest was only one aspect of general behavioral orientation toward a task, Kruglanski et al. examined the effect of incentives on qualitative features of performance. Their subjects were 32 high school aged students who were asked to volunteer for "a survey on youth movements." Subjects were randomly assigned to a reward condition or a no-reward condition. Reward subjects received the promise of a tour of the psychology department at Tel-Aviv University as a "thank you" for their participation. The no-reward group neither expected nor received any reward. All subjects were then asked to complete five tasks, two of which measured short-term recall, two creativity, and one the Ziegarnik effect (i.e., the tendency to display better recall for uncompleted as compared to completed tasks). Following their completion of the tasks, subjects responded to a questionnaire which asked them to rate their enjoyment of the experiment and their willingness to participate in similar projects in the future. The no-reward subjects

received higher scores than the reward subjects on measures for creativity, recall and susceptibility to the Ziegarnik effect. However, and somehwat surprisingly, differences on the measures of interest were marginal.

In discussing the results of their study, Kruglanski et al. noted that neither the self-perception theory postulated by Bem, nor the theory of cognitive dissonance (Festinger, 1957), which had formed the basis of much research, could adequately account for several nuances of their own findings. They, therefore, offered two rival hypotheses which they referred to as (1) the distraction hypothesis and (2) the affect hypothesis. The former assumed that extrinsic incentives might serve to distract or divert one's attention away from the task toward the attainment of the reward. The affect hypothesis suggested that the presence of important incentives might create "emotional interference" of a kind that disrupts skill acquisition. The combined effect of these mechanisms could account for the observed decline in the quality of performance and subsequent "liking" for the task. Moreover, the recognition of distracting and arousing consequences of incentives implied that the very act of offering a reward may have information value for the subject. That is, it may act as a signal to the person to call forth a particular pattern of attention and behavior.

A study by Lepper, Greene, and Nisbett (1973) sought to confirm what the authors call the "overjustification hypothesis" and lent support to the idea that rewards have a distracting influence. The overjustification hypothesis, combining elements of the self-perception and cognitive dissonance theories, postulates that contracting explicitly to engage in an activity for a reward should undermine interest in the activity, while receiving an unanticipated reward should have no such effect. Lepper et al. conducted their research in a school setting. Children who demonstrated initial interest in a drawing activity were randomly assigned to either an expected-reward, an unexpected-reward, or a no-reward condition. In the expected-reward group, children were asked to draw pictures in order to obtain a "Good Player Award." In the unexpected-reward condition, no mention of an award was made until after the children had completed their drawings. The no-reward group neither expected nor received any award. Results of the study showed that children who expected a reward displayed significantly less interest in the drawing activity during a postexperimental observation session. Moreover, the drawings of these children were judged (by three judges blind to the purpose of the experiment) as significantly lower in quality than the pictures drawn by children in the other two groups.

In a replication of this study, Lepper and Greene (1975) found that children who worked for an extrinsic reward

actually produced more drawings than children in the control group, but that their drawings were, again, of lower quality. Thus, the Lepper et al. studies support the arousal and distraction hypotheses put forth by Kruglanski et al., and have been referred to by Condry and Chambers (1978) as evidence for the "signal" effect of task-extrinsic incentives. That is, the anticipated reward may signal the individual to focus attention on the attainment of the goal, rather than on the demands of the task itself. The unanticipated reward has no such effect because it is not part of the context in which the task is undertaken.

With attention focused upon the receipt of a contrived reward, the learner apparently loses sight of ecological rewards of the task. Thus, the task seems less interesting--less rewarding. It appears that working for a contrived reward diverts attention away from process and exploration, towards output or production. Thus, quality is sacrificed for the sake of quantity. These outcomes are more readily understood in light of research which has examined changes that take place in the learning process when contrived rewards are in control.

The Effect of Rewards on Process Variables

While most motivational studies have focused only on the products of learning, there have been some attempts to

examine the learning process as it is influenced by extrinsic rewards. These studies, though few in number, argue compellingly for the thesis that anticipated rewards alter patterns of attention and behavior, often to the detriment of learning. Neimark and Lewis (1967) examined learners' "information gathering" activities during a problem-solving task. Children (10-12 years) were asked to detect a pattern on a problem board in which the pattern was concealed by a number of moveable shutters. Each shutter opening or "move" revealed certain information about the pattern. Subjects were asked to identify the pattern on the problem board as being one of several presented to them on an answer sheet containing all pattern possibilities, and to do so in as few moves as possible. Subjects were also asked to keep a record of each move and the pattern possibilities eliminated by it. Children in the control group received no further instructions. Those in the reward group were paid for successfully completing problems; they also had money taken away for each move they made. Neimark and Lewis examined several aspects of information gathering, including strategy, total errors, redundant information and ability to explain the correct rule for solving the problem. While methodological problems kept differences between the groups from yielding statistical significance, the observed differences were clearly in the direction of the authors' predictions. Rewards did tend

to have a detrimental effect on information gathering. The problem of methodology will be discussed more fully in the "Experimental Designs" section of this chapter.

In an attempt to understand more of process behavior, Maehr and Stallings (1972) examined the level of difficulty of tasks preferred by children who engaged an activity expecting to be evaluated, as compared with that of children who did the same activity for "fun." In this study, 8th grade children were randomly assigned to four groups. Two groups (external evaluation) were told that the task was a test of their ability and that the results would be given to their teacher. Two other groups (internal evaluation) were told that the task was given for fun and that they would be the only ones to judge how well they performed. Within each of these conditions, one group was given a set of difficult problems, and the other group a set of easy problems. All groups then answered a questionnaire which measured their interest in doing similar tasks in the future. Answers to the questionnaire indicated that the internal evaluation groups would be more willing to attempt a set of difficult problems in the future, while the external evaluation groups would prefer easier problems. Differences were strongest for children identified as being high in need for achievement. Thus, even the "threat" of evaluation may alter one of the key factors in learning--the willingness to challenge oneself with increasingly complex activities.

In a study of "social interaction" Garbarino (1975) extended the boundaries of process effects. Reasoning that children who were paid to teach might focus more on getting paid than on teaching, Garbarino offered 6th grade children theater tickets for "successfully teaching" a sorting game to a 1st grader. Process variables which Garbarino investigated included emotional tone of teacher/ student interactions, teaching style, and use of time. In addition, he took as performance measures the amount of learning and the number of errors made by students. Garbarino predicted that children who were promised a reward would adopt an "instrumental" orientation toward tutoring that would manifest itself in a more negative emotional tone, intrusive teaching style, and less efficient use of time. In addition, he predicted inferior learning and more errors by the pupils of these teachers. Three of the four hypotheses were confirmed. Differences in teaching style failed to reach significance, though the differences were in the predicted direction.

Rewarded tutors in the Garbarino study tended to display the "quantity over quality" orientation discussed earlier, engaging in more overall teaching behaviors but fewer "high level specific" behaviors. Moreover, the correlation between negative evaluations of task behavior and negative evaluations of person (pupil) was significant for the reward group, while it was nonsignificant for the

no-reward group. Garbarino interprets this finding as indicating that, for the rewarded tutors, "when the child made many errors, the tutor responded negatively to the child" (1975, p. 426). This would logically follow from the concept of rewards as having a distracting influence. When one's attention is focused upon achieving a goal, anything in the way becomes a means to an end, and it is likely to be regarded negatively if it threatens to become an obstacle.

One of the most fruitful studies to examine process was conducted by Chambers (1979). Sixty male undergraduates were asked to solve concept attainment problems consisting of an array of cards containing information, a worksheet for notetaking and reference, and a wheel which could be manipulated by the subject to obtain feedback. Subjects were randomly assigned to four groups. Two groups (reward groups) were paid $.75 for each solution, while two others (no-reward groups) were paid $3.00 prior to their participation in the experiment. Within each of these conditions, one group (specified) was told to do four problems, while the other group (not-specified) was told only to work until they were told to stop. All subjects were allowed to complete four problems. They were then given a posttest problem to see how much they had learned, and they were asked to complete a short questionnaire designed to measure attitudes toward the task, the learning context, and future participation in a similar experiment.

Results indicated that subjects who were paid for each solution adopted a different approach to the problem solving process than subjects who were not paid contingent upon their performance. Differences between the reward and no-reward groups were strongest when the amount of work to be done was not specified. Responses to the questionnaire indicated that subjects who were paid for their solutions were less willing to volunteer their time to similar projects in the future and that they felt more pressure of time during the experiment. In general, paid subjects began guessing earlier and made proportionately more guesses before solving problems. They worked more rapidly but chose to work easier problems. In addition, they tended to use a less efficient information gathering strategy. This was manifested in their failure to make use of their worksheets, and in their overreliance on a gambling strategy to solve problems. The gambling strategy yielded more information than a conservative focus only when the response was positive. If the response was negative, no information was obtained. Chambers points to this finding as evidence of an "answer orientation" among rewarded subjects. Indeed, one who viewed "getting" a solution as paramount to "learning" a solution, would be more willing to risk bypassing information in order to get the solution faster.

The interactions between the specified/not-specified conditions in the Chambers study, are also important. Their net effect was to diminish the difference between the reward and no-reward conditions. When the number of problems to be done was specified, the reward group did tend to work harder problems, work problems more completely, use more efficient information gathering strategies, and make better use of their worksheets. In his interpretation of these interactions, Chambers notes that there is more to be considered than the mere presence or absence of rewards. The conditions under which incentives are offered may help to determine the extent of their influence. When the amount of work to be done was unspecified for the reward group, subjects clearly had a choice between maximizing learning or maximizing payoff. When the number of problems to be done was specified, an element of choice was removed. There was no longer any advantage to working faster, so subjects worked more carefully. We will discuss the importance of free choice more fully in the "Experimental Designs" section of this chapter.

A fascinating study of the effect of contingent reinforcement on complex response sequences was conducted by Schwartz (1982). In this investigation, a classic behaviorist procedure was used to show that the negative effects of reinforcement are not restricted to highly probable or interesting activities, and that while

increasing the frequency of responses, reinforcement may alter the form of those responses. Schwartz conducted seven related experiments in which the subjects' task involved pressing keys to illuminate a panel and earn money. The reinforcement contingency required that subjects press two keys, four times each, in any order. A red light came on for three seconds following the completion of a successful sequence, signaling to the subjects that they had won the amount of money promised (either $.02 or $.05). Seventy different successful sequences were possible. In all seven variations of the expermient, the results were similar: Reinforcement of successful response sequences led to stereotypy; subjects tended to develop a dominant response sequence, repeating over and over again precisely what had worked in the past. When subjects were told that their task was to discover the rule of reinforcement, stereotypy did not develop. However, prior exposure to contingent reinforcement (i.e., pretraining on successful sequences) kept subjects from being able to discover the rule. When subjects were reinforced for response variability, they merely developed higher order stereotypes, producing just enough variability to satisfy the reinforcement contingency.

Schwartz observes that the tendency to develop stereotyped patterns of response is not confined to

situations where contingent reinforcement is used. In the world, "behavioral units" are common. People frequently develop stereotyped behavioral patterns as part of their daily routine. Moreover, successful execution of skilled activities depends on repeating again and again precisely those responses which work more efficiently and effectively than others. The housewife, for example, develops a routine for cleaning the house. Through practice and experience, she learns that certain sequences of behavior save time and energy. The tennis player, likewise, adopts a stereotyped sequence of responses (at the muscular level) for serving the ball, because that serve has proved more effective than others.

Thus, the fact that stereotypy develops is not surprising. What is surprising is that stereotypy can be induced by contingent reinforcement in situations where it is not required. In Schwartz' first experiment, not only did every subject develop a dominant response sequence (when the reinforcement contingency did not require it), but half of the subjects said later that they believed the response sequence they used was necessary, not merely sufficient, to produce reinforcement. Even more disturbing, from an educational perspective, is the fact that reinforcement induced stereotypy may transfer to related activities. In three of his experiments, Schwartz found that a history of reinforcement for successful sequences

interfered with subjects' problem solving ability on a later task. The practical implication for classrooms is that rewarding even low probability activities, such as memorizing the multiplication tables, in the hope that they will become high probability, may have a negative influence on later activities, such as developing mathematical reasoning ability.

The Schwartz study demonstrates that contrived reinforcement can change the nature of activity, inducing stereotypy when it is not required and interfering with performance on related activities. However, it leaves open the question of why contrived rewards have negative consequences, when conditions that produce stereotypy in the world do not. Just because the housewife has developed a routine for preparing meals, this routine does not interfere with her ability to be creative in the kitchen. In fact, one frequently finds that the most ingenious homemakers are also the most organized in their daily routine. Likewise, the most imaginative artists and craftsmen in any field are the very people who have "routinized" the most features of their trade. It would be difficult to imagine a pianist, who, having mastered technique (i.e., have developed stereotyped behavioral units for playing the piano), would then find it difficult to compose. On the contrary, the ability for composition should be enhanced,

because automatic responses have freed energy and attention for creative use.

When contrived rewards control the nature of activity, however, one finds just the opposite occurring. In the learning process studies reported here, contrived reinforcement contingencies have been shown to have negative influence on information gathering, problem solving, use of time, and eagerness for challenge. In interpreting the significance of his own study, Schwartz observes that contingent reinforcement seems to take "control away from something else" (1982, P. 57). That "something else" is the structural coupling of act and consequence. When ecological rewards control learning, the process and outcomes of learning are virtually inseparable. To say that one practices the scales daily in order to play better music is to say something about the quality of that practice. The outcome (better music) is structurally linked to the process of creating it (practice of a certain kind). The quality of one's practice will determine the quality of the music one plays. In turn, the quality of the music one wants to play will dictate the quality of the practice in which one must engage. Thus, to say that a person plays beautiful music is also to describe what that person has learned.

However, to say that a person practices the scales in order to earn a contrived reinforcer says nothing about the

quality of the practice. One must go beyond the musical context to find out what kind of practice is required by the reinforcement contingency. This is because the outcome (securing reinforcement) is linked only indirectly to the process (practicing the scales). The link is an event external to the act of making music. Thus, the consequence of the act tells the actor (or learner) nothing about the quality of the action. How the learner gathers information, what stereotyped units of behavior are developed, how time is used, and what is learned from behavior will be dictated, not by the demands of learning to make music, but by the demands of reinforcement. In fact, if one wanted to describe the behavior of practicing the scales in order to earn a reinforcer, one could do so merely by describing the reinforcement contingencies, without having to refer to learning at all. One could simply say that the player was able to execute a given pattern of muscular responses, a certain number of times, and at a given rate. Of course, accuracy would be important to the full description, and so would consistency of tone. But there would be no reason to refer to the player's internal states, to the awareness of the music being played, or to the understanding of how a given muscular reponse determined the quality of the sound that issued from the instrument.

Now, if one can circumvent references to learning in describing the act of playing the piano for contingent

reinforcement, is it not possible that the player can circumvent learning while, at the same time, accomplishing that act? If so, this might explain the person's inability to apply the meaning of what should have been learned in one context to the requirements of a related context, i.e., the negative transfer of reinforcement to later problem solving ability. It would also help to account for the person's apparent lack of knowledge about what was done, as in the case of Schwartz's subjects who were unable to explain the rule governing their reinforcement. In any event, it would clarify the difference between reinforcement induced stereotypy and stereotypy which develops in the process of task mastery: The one does not require learning, in the richer sense of the word, the other does. Of course, to say that a person does not learn anything while working for reinforcement would be inaccurate. A more accurate statement would be that what appears to be learned are only those aspects of activity which are made salient by the conditions of reinforcement.

Incentive Characteristics

We have already seen that many types of incentives (e.g., money, awards, evaluations) can affect interest, performance, and learning. Nevertheless, certain attempts to manipulate incentive characteristics are noteworthy.

One series of experiments (Deci, 1971, 1972a; Deci, Cascio, and Krusell, 1975) found social rewards (praise) to increase subsequent interest for males, but to have the opposite effect for females. Deci et al. used only an unanticipated reward condition; however, when Smith (1975) attempted to replicate this finding using monetary and social incentives as anticipated rewards, he found both to have an undermining influence, and no interaction with sex.

A study by Anderson, Manoogian, and Resnik (1796) examined the effect of various incentives--social, monetary, and symbolic--on the interest of four and five year-olds. Here, subsequent interst was decreased by money and symbolic rewards but was increased by praise. Chambers (1979) has offered an interesting analysis of social rewards which may explain contradictions in the literature. He points out that a conceptualization of any reward must take into account not only the nature of the reward (verbal, physical, etc.) but also the relationship between the recipient and the provider of the reward. If one receives a social reward from a person with whom he identifies strongly (i.e., whose role he has "internalized"), it may seem equivalent to giving oneself the reward, and, thus, have more intrinsic relevance for the person. This possiblity is most credible with young children, who readily adopt adult role models. The point to bear in mind is that rewards, like anything

else, are not all good or all bad. Their benefit or detriment will always be tempered by factors specific to the situation in which they are used.

Related to social incentives is the use of surveillance. Zajonc (1965) reviewed research on the effect of the presence of others on learning and performance. He concluded that, while surveillance facilitates the performance of well-learned skills, it tends to inhibit the development of poorly learned skills. Indeed, in the Anderson et al. study just described, the greatest motivational decline was found in a "control" condition where the experimenter was in the room with children but did not interact with them in any way. Likewise, Lepper and Greene (1975) found that being "watched" by a TV camera decreased subsequent interest in a task amoung nursery school children. Even the imposition of a deadline has been found to depress interest (Amabile, DeJong, and Lepper, 1976). It would seem that almost any external constraint can have the power to change the learning context and the potential for undermining intrinsic factors.

Task Characteristics

The detrimental effect of rewards seems to generalize across a wide variety of tasks. McGraw (1978) has presented an excellent review of some 50 studies in which the effect

has been documented. McGraw points out that the bulk of research, spurred by the pioneering efforts of Miller and Estes (1961), has focused on children's discrimination learning. The Miller and Estes study set out to investigate the effects of different levels of monetary incentives on the learning of a perceptual discrimination rule by 3rd grade children. The investigators found no differences in the number of errors made by subjects who were paid $.01 for each correct discrimination and those who were paid $.50. Both paid groups, however, made significantly more errors than a "knowledge of results only" group.

Since the Miller and Estes study, others have found similar decreases in performance with tasks involving verbal discrimination (Spence, 1970), picture discrimination (Spence and Dunton, 1967) and pattern probability learning (McGraw and McCullers, 1974). Concept discrimination (McCullers and Martin, 1971) and concept attainment (Condry, 1975; Chambers, 1979) tasks have also been used in similar studies, with the same results. Other tasks which have been shown susceptible to the detrimental influence of rewards include choice preference (Masters and Mokros, 1973), functional fixedness problem-solving (Glucksberg, 1962, 1964), insightful learning (Vesti, 1971) and incidental learning (Bahrick, Fitts, and Rankin, 1952; Johnson and Thomson, 1962; Staat and McCullers, 1974).

The research on incidental learning is particularly important to the present study, because it supports the notion that rewards act as an attention focusing signal. In the Staat and McCullers (1974) study, subjects were asked to learn nine paired associations, with reward subjects earning $.05 for each correct response. When the subjects had reached a criterion of six correct responses, the "training" period ended and they were given a recall test designed to check their incidental learning: Response items were supplied and subjects were asked to provide the stimulus item. Unpaid subjects recalled nearly twice as many of the stimulus items as the paid subjects. Thus, the attention focusing properties of extrinsic rewards may cause the learner to ignore other information in the learning context. Granted, the stimulus items in an experimental association task are not crucial information. But what of the questions on a classroom test? Surely they are as important as the answers which students are expected to remember.

Experimental Designs

Experiments in this field of research have relied heavily on traditional designs. Frequently, the result has been a lack of differences among groups, or findings that run contrary to intuition. Recall that in the Neimark

and Lewis study (1967), children were rewarded for detecting patterns, and their information gathering activities were observed. Chambers (1979) notes two important factors which may have contributed to lack of statistical significance in this study. First, the way rewards were administered may have offered beneficial information to rewarded subjects, confounding the results. Penalties exacted for each move, and the fact that no strategy but the correct one ever paid off may have signaled that careful work was required. In essence, the reward contingency shaped the behavior of rewarded subjects in ways that made them look like nonrewarded subjects. Second, constraints placed on the control group, such as self-monitoring of moves and instructions to keep the number of moves to a minimum, may have served to "reduce the freedom of an intrinsic context" (1979, p. 8). Both criticisms point to "choice" as being a critical factor in motivation research. If we are to discover what personal and intellectual factors are influenced by the presence of absence of rewards, then we must try to create situations in which the individual has the freedom to determine for himself the conditions under which a task will be engaged, processed, and terminated.

When attempts are made to preserve freedom of choice, results can be surprisingly realistic. Winston, Torney, and Labbee (1978), for example, investigated children's

self-reinforcement and found, in contrast to most similar studies, a tendency toward maximization of payoff and minimization of effort. The authors argue that earlier experiments had exerted too much control on children's behavior. Experimental instructions, training procedures, modeling cues given by adults, and little freedom to vary performance standards may all have contributed to the traditional finding that children's self-reinforcement schedules are self-demanding, and relatively stable across time. The effect may have been further enhanced, the authors note, by the fact that these studies typically lasted only one session. Winston et al. attempted a study in which external cues and controls were minimized. They asked 5th grade children to work at a wheel-turning task for four consecutive sessions. The children could select on each trial how many wheel turns would earn one token. Tokens were redeemable for a certain amount of cartoon-viewing time. Children were neither rewarded for maintaining high standards nor punished for lowering their standards. Reinforcement was simply contingent upon their performance, and the standard of performance was up to the individual. Thus, children were free to adopt one of two strategies for earning enough tokens to view a whole cartoon: They could either lower their standards, so that fewer wheel turns were required, or they could maintain high standards, which necessitated more (or faster) wheel turning.

Winston et al. found a significant drop in performance standards across sessions. Not only did children reduce their standards, they also lowered their overall rate of wheel turning. Given that the wheel-turning task offered few, if any, "intrinsic" rewards, and that it was presented strictly as a means to an end, and that cartoon viewing is probably a very desirable end for a 5th grader, these results are realistic. In the absence of external controls to guide them, and allowed to experience the fruits of a truly self-determined reward system over a period of time, children responded in a very predictable way: They tried to get the most reward for the least effort. Under normal (i.e., ecological) circumstances, would not any other response from a normal human being be considered impractical, if not altogether irrational?

While the Winston et al. study is intriguing for several reasons, it is presented here mainly to point out that changes in experimental conditions may have drastic influence on experimental results. To understand a human behavior, like learning, the first consideration should be the optimal circumstances under which that behavior is found to occur. Both research and experience suggests that learning can occur most efficiently when external (contrived) constraints and demands are minimized, and when the ecological consequences of learning are salient features of the learning context. Therefore, learning studies should attempt to

incorporate these features into research designs. Such an approach has been encouraged by researchers who are working to establish an ecological basis for the study of learning (e.g., Johnston, 1981; Bronfenbrenner, 1976), and its value to scientific inquiry is aptly summarized in W. I. Thomas' observation: "If men define situations as real, they are real in their consequences" (Thomas and Thomas, 1928, p. 572).

Summary

This chapter has presented research which indicates that many types of extrinsic (i.e., contrived) reinforcement can have undesirable consequences for learning. First, contrived incentives appear to decrease motivation or interest for learning activities. Second, they encourage an attentional and behavioral orientation which places quantity before quality and product before process. Third, they inhibit certain processes, including creativity, insight, and problem solving, which are generally considered important to learning. The present study sought to examine the occurrence of such effects in a setting where ecological rewards were salient and where the individual was given a maximum of free choice in engaging, processing, and terminating the learning activity.

CHAPTER III

THE DESIGN OF THE EXPERIMENT

Introduction

In Chapter I, some assupmtions about learning were adopted. One of these was that motivation to learn grows out of the human being's striving to become more competent in dealing with the demands of the enviroment he or she occupies. Another was that the use of extrinsic incentives to motivate learning becomes unnecessary when the context for learning provides coherence, responsiveness and engagement. These assupmtions guided the design of the present research along ecologically valid lines.

A primary concern was to create an enviroment, or context, where learning could occur but was not demanded or controlled from without. In Chapter II it was pointed out that certain laboratory experiments investigating intrinsic motivation may have placed demands on subjects which diminished the differences between rewarded and nonrewarded groups. Being asked to do a specified amount of work, anticipating a time limit, or just being told that one's task was to learn something may have signaled rewarded subjects to work more carefully than they would have

otherwise, or may have actually interfered with the standards for practice and progress which nonrewarded subjects would have set for themselves. Therefore, care was taken in the present study to minimize procedural constraints and experimenter influence.

Another important design consideration was creating a learning enviroment which would be coherent, responsive and engaging. In the world, motivation to learn only becomes a problem when one or more of these enviromental aspects is missing or concealed. If actions do not seem to be logically or consistently connected with events, if there is not information to signal progress or completion of activities, if nothing attracts or requires attention, then the enviroment ceases to have meaning, and learning or not learning has no consequence. Admittedly, when these conditions obtain, contrived rewards have some value. They may induce artifical coherence, provide an externally controlled source or response, and engage attention, if only toward their own attainment. In this way, contrived reinforcers can increase the frequency of responses which otherwise might not occur at all. The aim of this study was to investigate the influence of a contrived reward in an ecological setting, i.e., where learning could be expected to occur in response to ecological rewards. Such a setting had to provide a logical

framework for activity. All instructive feedback necessary for progress had to inhere within the context of the activity. Finally, the activity and its context had to engage interest and attention. These requirements determined the choice of the learning activity and the arrangement of the experimental setting.

The Sample

Subjects were forty 2nd, 3rd, and 4th grade boys at the P.K. Yonge Laboratory School. The decision to use only boys in the study was based on pilot data in which boys were generally found to be more attracted to Labyrinth than girls. Parents of all boys in the 2nd, 3rd, and 4th grades were mailed an informed consent letter, explaining the purpose and procedures of the experiment, and asking that they give written permission for their son to participate. Fifty-five parents returned forms giving their consent. These returns were stratified by grade level, and 40 boys were randomly selected to participate in the experiment. The other 15 names were placed in a pool, and drawn out when subjects had to be dropped. In all, seven subjects were replaced in the course of the experiment: Four subjects were dropped due to prior familiarity with the game; two were replaced due to absence on the first day of their treatment; one 2nd grader elected to remain in his classroom because he did not want to get behind in his work.

Subjects were randomly paired within grade levels. Each pair, or team, was randomly assigned to one of four treatment conditions: No-reward/No-reward (NN); No-reward/Reward (NR); Reward/Reward (RR); Reward/No-reward (RN). Each team participated in two experimental sessions. The NN subjects were not offered the contrived reward at either session. The NR subjects were offered the reward at the second session, but not at the first session. The RR subjects were offered the reward at both sessions. The RN subjects were offered the reward at the first session, but not the second session.

The Learning Activity

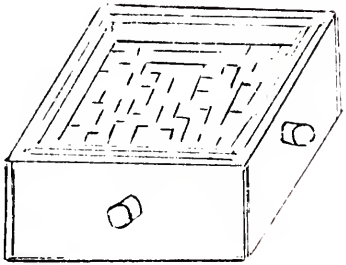
One criterion for choosing the experimental activity was that it must have high ecological (intrinsic) appeal. That is, the task had to look interesting and be able to engage subjects' interest with a minimum of introduction by the experimenter. Other criteria dealt with the learning requirements of the task. It was essential that the task entail a hierarchy of skills through which a subject could progress rather rapidly with practice. Moreover, all the feedback necessary for skill development had to be contained within the activity itself. Thus, skill levels could be distinguished and experimenter influence could be reduced. The final criterion for selection of

the task was that it should be relatively content free. This eliminated the need to assess prior learning in a content area.

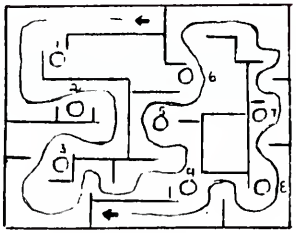
The activity chosen was a commercial board game called Labyrinth, manufactured by the Brio Scanditoy Corporation. The game, shown in Figure 1, consists of a box on which an assortment of three trays can be mounted and tilted by manipulating two knobs on adjacent sides of the box. The trays contain mazes of varying difficulty through which the player must move a steel ball. The ball can be made to roll in directions parallel to the sides of the tray by moving one knob at a time. To make the ball move diagonally, both knobs must be turned simultaneously. The object of the game is to move the ball through the maze without dropping in any of the holes placed strategically throughout the maze. For a more complete description of the game, the reader may refer to the "Procedures" section of this chapter.

Experimental Setting

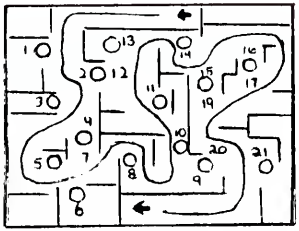
The ideal setting for this type of study would probably be in the home, where games are typically played. Placing Labyrinth in the homes of children, however, would have meant a loss of experimental control and would have necessitated elaborate systems for monitoring or



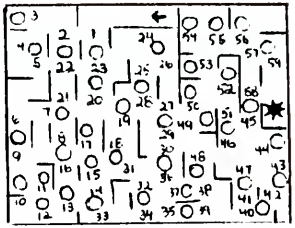
THE GAME BOARD BOX



BOARD #1



BOARD #2



BOARD #3

Figure 1. "The Labyrinth Game."

self-reporting of activity. Therefore, it was decided that the experiment should be conducted under the guise of an evaluation. Subjects were told that the experimenter was evaluating Labyrinth for possible purchase by the local school system, and that they had been chosen to help her by playing the game and answering some questions. This "cover" helped to account for the questionnaire administered at the close of each session. It also concealed from subjects the fact that their skill development with the game was a focus of the experiment.

Subjects were teamed to avoid the uncomfortable effects of isolation in a lab. This teaming also made it possible for subjects to pit their skill against one another if they so desired. Allowing this competitive affordance of the game to be realized also increased the ecological validity of the design.

All activity in the experimental room was recorded on videotape by a concealed camera. (Only one subject detected the presence of the camera, and this was after all data regarding him had been collected.) One reason for this unobtrusive observation is obvious: People often feel they need to "perform" if there is a camera present. Moreover, in the Lepper and Green study (1975) being monitored by a TV camera worked to decrease intrinsic motivation. The most important reason for videotaping, however, was that it

allowed the experimenter, who was busy monitoring the sessions, to collect from the tapes a great deal of qualitative data which might have been lost otherwise.

Contrived Reward

Subjects in the reward conditions (NR, RR, RN) were paid for winning matches. Recall that this offer was made to the NR group only on the second day, and it was made to the RN group only on the first day. Subjects were told that each time they played a match the winner would be paid a dime. A "payoff" was made every ten minutes during the session when the experimenter went into the experimental room to inquire about how the children were doing and whether they wanted to leave yet.

Money was chosen as the reward for three reasons. First, in experiments that have used various incentives, subjects typically value money above other material rewards, such as gum, candy, or toys (Haddad et al., 1976; McCullers and Martin, 1971). Second, it was felt that the universality of monetary reward would improve the generalizability of the study. Finally, a purely practical concern: Money was easier to handle and distribute, and did not threaten to conflict with any school or parental rules.

What performance criterion to use as the reward contingency was a crucial question. Bearing in mind that

rewards have clearly demonstrated their effectiveness for increasing the frequency of reinforced responses, the possiblity of shaping the behavior of subjects had to be avoided. Therefore, the possibilities of making the reward contingent upon the number of trials to mastery, or the amount of play, or the difficulty level of the boards used were all eliminated. Another consideration was maintaining the ecological validity of the reward context. In the real world, there are rarely enough "goodies" to go around, and people are forced to vie for salaries, goods and services, or recognition. In most schools, the reward structure is equally competitive. Only the "best" students get the high grades, the scholarships, and the diplomas. Furthermore, while the primary interest of this study was learning, the fact that the experimental activity was a game could not be overlooked. In the world, games have both individual and social aspects. A player may practice individually to increase his skill or competence at the game. He plays or competes in order to test that skill. Even so-called "individual sports" like golf, while practiced and scored individually, are played competitively.

In order to simulate these aspects of real-world reward structures, the decision was made to make the reward contingent on winning matches. Thus, teams were free to set their own standards for competition, in that

they could choose among three difficulty levels of boards on which to play; but individuals were required to develop superior skill in order to be rewarded. Subjects kept their own record of wins on a tally sheet provided by the experimenter. A win was clearly defined as "getting further through the maze" than one's partner on a given match. All subjects were told that they were not required to play matches, but, if they did, the should score themselves by this standard. In addition, rewarded subjects were told that they would receive a dime for each match they won. Details of the instructions and procedures in the experiment follow.

Procedure

The experiment took place during regular school hours, over a period of six weeks. All subjects participated in two experimental sessions, scheduled within 72 hours of each other. Seven days after the second experimental session, subjects were called back for a postexperimental session in which Reengagement Skill and Knowledge of Competence were assessed.

First Experimental Session

The children were brought to the experimental room by the experimenter (E) and seated on either side of a large table.

E seated herself at the end of the table in front of a Labyrinth game.

"This is a game called Labyrinth. Has either of you ever seen a game like this before?" If either child said, *"Yes,"* E probed to determine if the child had one at home or was very skilled with the game already. If so, both subjects were dismissed. E thanked them for their willingness to participate in the evaluation, but explained that the evaluation required the opinions of children who had never played the game before.

"I have been asked to evaluate this game for the school system. You have been chosen to help me. In a minute, I will give each of you a game like this one. I would like for you to play it and, then, answer some questions for me."

The RR and RN groups were then told, *"I am going to give you a chance to win some money. We will come back to that in a minute."*

E referred to boards #1 (the easiest board) and #2 (the moderately difficult board) which were placed beside her game. *"These are the playing boards. As you can see, this one* (board #2) *is a little more difficult than this one* (board #1). *This one* (board #3, the very difficult board) *is the advanced board."*

E picked up board #1 and placed it on her game. *"The object of the game is to roll this little ball along the*

path marked by this brown line without dropping it in any holes. To move the ball, you must move the board using the knobs."

E demonstrated how the maze should be negotiated. . . . *"The front knob moves the board from side to side. The knob on the right moves the board from front to back. If you turn both knobs at the same time, the board will move diagonally. Now, you try it."* E allowed each child one practice trial.

"That is basically how the game is played by one person. You might want to practice until you can get through the maze every time. Then, you might work to improve your speed on that maze, or you might go on to a more difficult board. Do you have any questions about how the game is played?" E waited, and answered any game-related questions, being careful not to give informaiton which might prejudice the child's attitudes or tip him off to efficient playing strategies.

"Let me ask you some questions to be sure you understand. How do you make the ball move? . . . Which way does the board move if you turn the front knob? . . . The side knob? . . . Both knobs together?"

"You have seen how this game is played by one person. It can also be played by two people in a match. If the two of you want to play against each other, both of you will move the ball through the maze until you reach the end

or drop in a hole. The player who gets further through the maze wins the match. If both of you get to the end or drop into the same hole, that match is tied--nobody wins."

E referred to the score sheet. *"Here is a sheet for you to keep score on if you decide to play matches. Just make a mark under your name each time you win a match."*

The RR and RN groups were then told, *Each time one of you wins a match, I will give you a dime."*

"Let me ask you a couple of questions to be sure you understand about scoring. If you decide to play a match, what is the first thing you must do? . . . Who wins a match? . . . (Referring to board #2, hole 9/21) *If you dropped in this hole, what would your score be? . . . How do you know that? . . . Who wins a tie?"* E explained scoring and rules again if the children seemed to be confused.

"Remember, you do not have to play matches. You may have just as much fun playing by yourself. Do you have any more questions before we begin?"

When there were no further questions, E gave each child a game and made sure he was comfortably seated. She watched for a moment to make sure the children understood how to manipulate the game, then excused herself. *"I have reports to fill out, so I'm going to work in the next room. If you need me, just knock on the door. You may leave any time you wish, but remember, before you do, I need to ask you some questions."*

E left the room and observed the children from a remote VTR in the next room. She returned in ten minutes and said:

To the NN and NR groups, *"How are you getting along? . . . Have you played any matches yet?"*

To the RR and RN groups, *"How are you getting along? . . . Have you won any money yet?"* E then gave these reward subjects a dime for each mark on the score sheet.

E stayed approximately one minute, then excused herself again, reminding the children that they were free to leave whenever they liked, and that they could take a break if they wanted. This process was repeated every ten minutes until one or both subjects asked to be excused, or until the one-hour time limit established for the sessions (but never mentioned to the children) was up, or until both subjects showed signs of losing interest in the game by being off-task for four out of five minutes.

At the end of the session, E asked one child to wait outside while she asked the other child some questions. E administered the questionnaire to the first child, then excused him for the day, then did the same with the second child. Both children were told that they might be asked to come back again the next day. RR and RN subjects were requested not to mention the money to their classmates, because the E's funds were limited and she might not be able to give dimes to everyone.

The Second Experimental Session

The children arrived and were seated in front of their games.

"Yesterday you had a chance to get acquainted with Labyrinth. Today, I would like you to work with it, again, so I can ask you some more questions. Do you remember all the things we talked about yesterday?. . . What is the object of the game?. . . How do you keep score if you want to play matches?"

The NR group was then told, *"Everything is the same today, except that, today, each time one of you wins a match, I will give you a dime."*

The RN group was told, *"Everything is the same today, except that, today, I will not be able to give you a dime for each match you win. My money has run out."*

E allowed the children to ask any questions they had and then excused herself as in Session One. The same cycle of observation, returning to the room, giving dimes to the reward groups, and administering the questionnaire was repeated. When the children were excused from this session, E thanked them for their help in the evaluation and said that she might ask to see them again in a few days.

The Postexperimental Session

Each child was called to the experimental room individually for the followup. E greeted the child in the

hallway outside the room and asked him to wait inside for a few minutes while she tried to locate a misplaced file which she needed before they could proceed. When the child entered the experimental room, he found a Labyrinth game, assorted comic books, and a Rubik's Cube on the table. E watched him on the remote monitor in the next room and recorded his activity, as it occurred. Time spent engaged in playing Labyrinth, reading comics, manipulating the Cube, or just sitting quitely was noted.

After five minutes, E returned to the experimental room, apologized for the delay and said that she had found the papers she needed.

"Today, I would like to find out how well you have learned to play Labyrinth. I would also like to see if you know how well you play. Before we begin, would you like to take a few minutes to warm up?"

When the child indicated that he was ready to begin, E explained, *"Now, I would like you to try to get all the way through each of the three mazes. I'll give you as many as five tries on each maze. Before you take each try, think for a minute, and tell me, before you begin, if you will make it all the way through the maze on that try. Do you understand?"*. . . After answering any questions the child had, E asked him to put board #1 on the game.

If a child completed a maze on the first try, or if he completed it twice in succession, E asked him to go on

to the next board. For board #3, the "end" of the maze was set by the subject himself. To do this, E asked, *"How far have you gone on the advanced board before?"* Whatever hole was named by the child as his highest score on board #3 was then taken as the end of that maze.

E recorded the child's score on each trial and his prediction. When all the trials were completed, E thanked the child for his help and excused him.

Data Collection for Within-Session Variables

Some within-session data were collected during the experimental sessions. These included, the time the session started, the time and reason it was terminated, and the time of the first match. All other within-session data were collected from videotaped recordings of the sessions. The instrument used to code these data is shown in Appendix A.

Qualitative Measures

Instructional Events. Coaching or offering advice with the intent of improving a partner's play.

Praise. Comment intended to acknowledge partner's good play (included nonverbal behavior, such as applause).

Encouragement. Comment intended to console partner for poor play or relieve partner's frustration.

Look-at-Me-Statements. Boasting or demanding partner's attention or praise.

Arguments. Prolonged disagreements over turn, score, or rules of play.

References to Cheating. Any statement containing the word "cheat," e.g., "You cheated." "This is how I cheat," etc.

Interference. Statement or action intended to annoy, distract, or disrupt partner's play.

Instructional Events, Praise, and Encouragement were aimed at measuring the degree of cooperation in the subject's social interactions. Look-at-Me-Statements, Arguments, References to Cheating, and Interference attempted to measure the negative influence of competition, or what might be called "unfriendly competition."

These data were recorded for consecutive intervals of a session. An interval was defined as 50 feet of videotape (approximately 3 minutes). A behavior was coded only once for a given interval, regardless of the number of times it occurred during that interval. Any behavior which was ongoing for more than one interval was recorded for each interval during which it occurred. In addition, specific observations were noted for each session. Subject's exact words to each other during Arguments and Instructional Events were recorded whenever possible. The nature and

degree of Interference was noted wherever it occurred. Any instance of cheating, whether or not it was accompanied by a verbal Reference to Cheating, was also described in detail.

Descriptions of actual cheating were compiled to determine whether patterns of cheating might exist and whether these patterns were consistent among groups. Three specific types of cheating were observed:

Cheating a Partner. Lying to one's partner or falsifying the score card in order to win a match or improve one's cumulative score.

Cheating the Experimenter. Lying to the experimenter or falsifying the scorecard in order to win more money. This form of cheating, of course, was unique to reward groups, and therefore, was not included in the primary data analysis. This type of cheating involved a cooperative deception and the dialogue which transpired was recorded verbatim by the experimenter.

Minimax Strategies. Attempts to minimize effort or competition in order to maximize scores or profits. This might also be called "cheating oneself" or "reducing challenge." Usually, it was accomplished by making a rule such as "finishing the maze equals winning the match," or "shortcutting through the maze is fair play," or "the first person to drop in loses, regardless of the other person's position at the time."

Quantitative Measures

Mean Difficulty of Boards. The board used by each subject during each interval was noted. The number of the board (either #1, #2, or #3) was recorded, and these numbers were averaged across intervals for both subjects to yield a team measure of the average difficulty of boards used during that session.

Intervals Containing Match Play. Match Play was recorded for every interval during which the game was being played competitively, whether or not subjects were tallying their scores. The percentage of total session intervals during which Match Play occurred was calculated as a measure of time spent in competition, rather than practice.

Practice Time Preceeding the First Match. This measure was calculated as the number of minutes which elapsed between the time subjects first began playing the game to the time of the first interval in which match play was recorded.

Engaged Time. This measure was defined as the percentage of total session time subjects spent actually engaged in playing their games. A stopwatch was used to measure the amount of time each subject was nonengaged during each interval. Nonengagement was clocked whenever a subject was not playing his own game. Thus, stopping

to watch one's partner play was included in nonengaged time, along with resting, looking around the room, reading a book, and so forth. Nonengaged time was subtracted from the total session time to yield a raw measure of time engaged in playing the game. Engaged Time was then calculated as a percentage of total session time.

The Questionnaire

The questionnaire administered at the close of each session contained 15 items. A copy of the questionnaire appears in Appendix B. Questions were presented orally and subjects' responses were marked on the questionnaire. Responses were then coded numerically to yield a combined score for each team in the following six categories:

Liking of the Game. This was measured by questions 1, 2a and 2d, 3, and 14.

Feelings of Frustration. This was assessed by questions 2b, 8, 9, and 10.

Ratings of Game Difficulty. This was assessed by questions 2c and 2e.

Expressions of Skill Requirements of the Game. This was measured by items 6, 7, and 15.

Internality of Attributions (for winning or losing matches). This was measured by questions 12 and 13.

Importance Placed on Competition. This was assessed by items 5 and 11.

(In the final data analysis, items 1 and 2a were excluded because of ceiling effects. Probably due to the wording of the questions, all subjects gave the same answer. Item 4 was excluded from the analysis because it had no direct bearing upon the experiment, but was used in the questionnaire to introduce question 5.)

Data Collection for Postexperimental Variables

Data on Reengagment, Mean Sources on the Skill Test, and Accuracy of Predictions were collected during the postexperimental session. Appendix C shows the instrument used to collect data on these measures:

Reengagement was defined as the amount of time during a five-minute free-choice period a subject spent playing Labyrinth. This time was recorded to the nearest half-minute.

Mean Scores on the Skill Test were measured over a maximum of 15 trials, five trials per board. On each trial, a raw score was recorded as the number of the hole where the ball fell in. These scores were then adjusted by assigning consecutive numbers to each hole for boards #1 through #3. Thus, a raw score of 12 (hole 12) on board #2 became an adjusted score of 21. A subject's adjusted scores were then averaged across trials to yield a mean score.

Accuracy of Prediction of success or failure over a series of trials on the skill test served as a measure of

subjects' knowledge of their competence with the game. Before each trial, a subject said "yes," he would get all the way through the maze on that trial, or "no," he would not. Predictions were compared to outcomes across trials and the percentage of trials on which the subject predicted the outcome correctly was then calculated.

Data Analysis

All within-session variables were analyzed by team. Where data had been collected individually, the subjects' scores were averaged into a team score. A 2 × 4 split-plot ANOVA was used to determine whether there were differences between teams in the four treatment conditions for each of the within-session measures. Nine qualitative variables, 4 quantitative variables, and 6 variables defined by categories of the questionnaire entered into the primary analysis. The ANOVA for each of these variables contained two levels of Time and four levels of Condition. Every team received two treatments, at Time 1 and Time 2, but the treatment differed according to the Condition of the subjects. Graphically depicted, the design for the analysis of within-session variables was as follows:

Condition	Time 1	Time 2
NN	(N)	(N)
NR	(N)	(R)
RN	(R)	(N)
RR	(R)	(R)

Reliability of the experimenter's observations of the qualitative variables was established by estimating the variance among ratings done by the experimenter and two other raters. One tape from each of the four conditions was chosen at random after the experimenter had coded all data. Two persons blind to the hypotheses of the experiment were instructed in using the observation instrument. Instruction was based on tapes recorded during the pilot. Following the instruction period, each observer watched the tapes and coded the data privately. For each tape, rating of the observers and the experimenter were analyzed by means of the Variance Component Estimate procedure in the SAS package. The percentage of total variance among the three ratings which was actually due to differences among conditions was then calculated for each behavior using the formula:

$$\frac{\text{variance associated with tape}}{\text{var. assoc. with tape + var. assoc. with rater + error}}$$

The postexperimental variables were analyzed as individual data. Subjects' scores on Reengagement, Mean Scores on the Skill Test, and Accuracy of Predictions were subjected to a one-way ANOVA to determine whether there were reliable differences among conditions. For all variables, the SAS package was used to conduct the Analysis of Variance.

Follow-up comparisons were made using either the Bonferroni t statistic for complex comparisons or Tukey's procedure for pairwise comparisons. Both statistics control the error rate per family. The significance level for probabilities was set at .05. The results of these analyses are presented in Chapter IV.

CHAPTER IV

RESULTS

Introduction

To address the questions of how a contingent monetary reward would influence learning process, social interactions, and attitudes of children learning to play a game of skill, data were subjected to a 2 × 4 split plot analysis of variance. Questions pertaining to skill development, knowledge of competence, and willingness to reengage the game were addressed by means of a one-way analysis of variance. Table 1 presents a summary table of the variables, the direction of predictions for hypotheses as they were presented in Chapter I, and a description of the analysis of variance procedures.

The extent of the relationship among certain variables was evaluated by Pearson product moment correlations. Complete correlation matrices are presented in Appendix D (see Tables A-1, A-2, and A-3). Wherever these correlations are pertinent to the results, they are reported as coefficients of determination (R2), an expression of the amount of variance two measures hold in common.

TABLE 1

Summary Table of Variables, Predictions, and Analysis of Variance Procedures for the Hypotheses of the Study

Variable	Prediction	2×4 Split Plot* ANOVA	One-Way ANOVA
1. Intervals Containing Match play	N < R	✓	
2. Practice Time Preceeding First Match	N > R	✓	
3. Engaged Time	N > R	✓	
4. Mean Difficulty of Boards	N > R	✓	
5. Minimax Strategies	N < R	✓	
6. Instructional Events	N > R	✓	
7. Interference	N < R	✓	
8. Look-at-Me Statements	N < R	✓	
9. Arguments	N < R	✓	
10. Praise	N > R	✓	
11. Encouragement	N > R	✓	
12. Feelings of Frustration	N < R	✓	
13. References to Cheating	N < R	✓	
14. Cheating a Partner	N < R	✓	
15. Mean Scores on Skill Test	N > R		✓
16. Accuracy of Predictions on Skill Test	N > R		✓
17. Ratings of Game Difficulty	N < R	✓	
18. Expressions of Skill Requirements of the Game	N > R	✓	
19. Internality of Attributions	N > R	✓	
20. Expressed Liking of the Game	N > R	✓	
21. Importance Placed on Competition	N < R	✓	
22. Reengagement	N > R		✓

*The nature of the hypotheses presupposed a two-factor interaction. Therefore, wherever the overall F test was nonsignificant for the condition × time interaction, the null hypothesis of no differences was not rejected. If a significant condition × time interaction was found, the analysis proceeded to test whether the interaction was due to specific N vs. R differences (i.e., Time 1 vs. Time 2) or to combined NN, NR, RN, or RR differences (i.e., Condition). Specific comparisons were then made to determine the location and direction of the differences.

An estimate of the total variance among the ratings of the experimenter and two observers blind to the hypotheses of the experiment which was due to actual differences among conditions is reported for qualitative variables. The results of the data analysis are presented by major areas of interest. For each variable, results of the analysis are presented, followed by summary tables of the analysis of variance and any follow-up comparisons that were performed.

Learning Process

Five variables were analyzed in an attempt to determine whether the four groups differed in their approach to the learning process. (The first three of these assessed the influence of the contrived reward on the amount of time subjects spent competing, practicing, and actually engaged in playing their own game. The other two examined the possible tendency of subjects to undermine their own skill development.)

Percentage of Intervals Containing Match Play (Hypothesis 1)

Table 2 summarizes the results of the split plot analysis of variance. Because there was a significant condition × time interaction, simple effects were analyzed for time 1 and time 2. The results of these follow-up comparisons of simple effects are summarized in Table 3.

TABLE 2

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Percentage of Intervals Containing Match Play

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	26.69	23.79	24.74	15.70
NR	29.08	16.59	52.45	22.10
RN	64.08	38.51	32.12	41.36
RR	70.63	20.31	71.81	25.31

Source	df	SS	MS	F
Condition	3	10785.45	3595.15	3.10*
Error	16	18530.36	1158.15	--
Time	1	54.83	54.83	.18
Condition*Time	3	3877.94	1292.64	4.34*
Error	16	4762.91	297.68	--

Time 1 vs. Time 1	df	SS	MS	F
NN	1	9.46	9.46	.03
NR	1	1364.92	1364.92	4.59*
RN	1	2554.88	2544.88	8.58*
RR	1	3.49	3.49	.01

Condition	df	SS	MS	F
at Time 1	3	7911.23	2637.08	8.86*
at Time 2	3	6752.16	2250.72	7.56*

*$p \leq .05$

TABLE 3

Specific Comparison for Percentage of Intervals Containing Match Play

Comparison	Value of the Contrast	Standard Error
[a]Time 1		
NN + NR vs. RR + RN	-78.98*	15.43
[b]Time 2		
NN vs. NR	27.71	7.72
NN vs. RN	- 7.38	7.72
NN vs. RR	-47.07*	7.72
NR vs. RN	-20.33	7.72
NR vs. RR	-19.36*	7.72
RN vs. RR	-39.69*	7.72

*$p \leq .05$

[a]Using Bonferroni t, which controls error rate per family.

[b]Using Tukey's procedure, which controls error rate per family.

The results indicate that subjects in the no-reward conditions spent significantly less time playing matches. Whether the reward was introduced (NR) or withdrawn (RN) also made a difference. At time 2, there was no difference between these groups and the NN group. The differences between the RN group and the RR group, however, was significant. At time 2, when the reward was introduced (NN vs. NR), there was not a significant increase in competitive play. Competition declined significantly, however, when the reward was withdrawn (RR vs. RN).

Practice Time Preceding the First Match of a Session (Hypothesis 2)

The summary of the split plot analysis of variance for practice time preceding the first match appears in Table 4. A simple main effect of condition was significant for time 1, but not for time 2. Therefore, a follow-up comparison was performed for time 1 only. The result of this comparison is shown in Table 5. At time 1 the no-reward groups spent significantly more time practicing before playing their first match. Although the effect was not significant at time 2, an examination of the means shows that when the reward was introduced (NR) subjects spent more time practicing than when condition remained the same (NN, RR). Also, the withdrawal of the reward (RN) corresponded to a slight increase in practice time. There was a negative

TABLE 4

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Amount of Practice Time Preceding the First Match

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	20.00	12.85	14.80	8.07
NR	32.40	18.78	12.40	14.26
RN	13.20	13.85	17.80	15.93
RR	13.60	8.79	6.20	4.20

Source	df	SS	MS	F
Condition	3	800.20	266.70	.99
Error	16	4323.20	270.20	4.33*
Time	1	490.00	490.00	--
Condition*Time	3	767.40	255.80	4.10*
Error	16	997.60	62.35	--

Time 1 vs. Time 1	df	SS	MS	F
NN	1	67.60	67.60	1.08
NR	1	100.00	1000.00	16.03*
RN	1	52.90	52.90	.84
RR	1	146.90	136.90	2.19

Condition	df	SS	MS	F
at Time 1	3	1204.00	401.33	6.43*
at Time 2	3	363.60	121.20	1.94

*$p \leq .05$

TABLE 5

Specific Comparisons for Amount of Practice Time Preceding the First Match

Comparison	Value of the Contrast	Standard Error
[a]Time 1		
NN + NR vs. RR + RN	25.60*	7.06
Time 2		
No specific comparisons were made; F = 1.94		

*$p \leq .05$

[a]Using Bonferroni t, which controls error rate per family.

product moment correlation between practice time preceding the first match and percentage of intervals containing match play (-.64), resulting in an R2 value of .41 for these measures.

Engaged Time (Hypothesis 3)

Engaged time was defined as the percentage of time an individual spent actually playing his own game, as opposed to watching his partner play, resting, looking around the room, etc. The summary of the split plot analysis of variance for this variable appears in Table 6. Because there was a significant condition × time interaction, simple effects were analyzed at time 1 and time 2. The results of these follow-up comparisons are summarized in Table 7. The results indicate that the percentage of engaged time was significantly higher when no reward was offered. The effect was consistent at time 1 and time 2. R2 for engaged time and practice time preceding the first match was .26. R2 for engaged time and percentage of intervals containing matches was .41.

The Mean Difficutly Level of Boards Used During Play (Hypothesis 4)

The difficulty level of the game boards used was calculated as a team average for each session. Boards were assigned a number (1, 2, or 3) corresponding to their difficulty level. Numbers of boards used by both players

TABLE 6

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Percentage of Engaged Time

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	89.73	4.41	83.27	7.86
NR	82.17	7.45	60.33	9.24
RN	70.17	13.10	77.25	8.50
RR	69.69	8.23	54.47	3.69

Source	df	SS	MS	F
Condition	3	2623.11	874.37	8.81*
Error	16	1587.12	99.20	--
Time	1	657.39	657.39	17.46*
Condition*Time	3	1079.25	359.75	9.56
Error	16	602.32	37.65	--

Time 1 vs. Time 1	df	SS	MS	F
NN	1	104.45	104.45	2.77
NR	1	1192.46	1192.46	31.67*
RN	1	125.46	125.46	3.33
RR	1	314.27	314.27	8.35*

Condition	df	SS	MS	F
at Time 1	3	1427.69	475.90	12.64*
at Time 2	3	2276.68	758.23	20.13*

*$p \leq .05$

TABLE 7

Specific Comparisons for Engaged Time

Comparison	Value of the Contrast	Standard Error
[a]Time 1		
NN + NR vs. RN + RR	32.04*	5.49
[b]Time 2		
NN vs. NR	22.94*	2.74
NN vs. RN	6.02	2.74
NN vs. RR	28.80*	2.74
NR vs. RN	-16.92*	2.74
NR vs. RR	6.36	2.74
RN vs. RR	22.78*	2.74

*p .05

[a]Using Bonferroni t, which controls error rate per family.

[b]Using Tukey's procedure, which controls error rate per family.

were averaged across time intervals to yield a mean score. These scores were then subjected to the split plot analysis of variance. The results of this analysis are summarized in Table 8. There were no significant differences among the four groups in difficulty level of boards used. R2 for mean difficulty of board and intervals containing matches was .06. For mean difficulty of boards and practice time preceding the first match, R2 was .03. An examination of the means shows slight differences in favor of the no-reward conditions. Reasoning that differences may have been masked by the averaging procedure, a separate analysis was performed on variability of boards used.

A variability score was generated by averaging the amount of time spent on each board across session intervals. The variance of this average around the perfect mean of .33 was then calculated using the formula $\frac{X - \bar{X}}{N}$; where X is the percentage of intervals during which a board was in use, $\bar{X}$ is the ideal mean of 33%, and N is the number of time intervals which entered into the calculation of variance. The variances for each board were then summed to yield a total variance score for each team. The split plot analysis of variance was then carried out. The summary of the results of this analysis appears in Table 9. Again, there were no differences among the four groups. However, the relationship for board variability and other process factors was greater than that for board difficulty. R2

TABLE 8

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Mean Difficulty of Boards Used During Play

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	1.75	.14	1.79	.25
NR	1.72	.20	1.71	.24
RN	1.55	.20	1.92	.53
RR	1.45	.20	1.51	.37

Source	df	SS	MS	F
Condition	3	.537	.179	1.82
Error	16	1.572	.098	--
Time	1	.130	.130	1.78
Condition*Time	3	.231	.077	1.06
Error	16	1.168	.073	--

TABLE 9

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Mean Variability of Boards Used During Play

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	.047	.02	.091	.06
NR	.139	.12	.270	.16
RN	.197	.19	.171	.20
RR	.279	.15	.316	.14

Source	df	SS	MS	F
Condition	3	.264	.088	2.59
Error	16	.543	.034	--
Time	1	.022	.022	3.17
Condition*Time	3	.031	.010	1.49
Error	16	.111	.007	--

for board variability and intervals containing match play was .30. For board variability and amount of practice time preceding the first match, R2 was .23. There was also a negative correlation between board variability and mean difficulty of boards (-.35), R2 being .12.

Instances of Employing Minimax Strategies (Hypothesis 5)

Minimax is an abbreviation for strategies designed to minimize effort or competition in order to maximize scores. (While cheating one's partner and cheating the experimenter are actually subclasses of this variable, they are considered separately as measures of social interaction.) Instances of minimax included (a) making a rule that finishing a maze was equivalent to winning a match, (b) agreeing to count intentional or accidental shortcuts through the maze, and (c) agreeing that the first player to drop in a hole was the loser, regardless of the other player's position at the time. The summary of results for the split plot analysis of variance appears in Table 10. The results indicate that there were no significant differences among the groups in the frequency with which they employed minimax. An examination of the means, however, reveals a slightly lower frequency in no-reward groups. R2 for the relationship between employment of minimax and the amount of money earned was .23.

TABLE 10

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Instances of Employing "Minimax" Strategies

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	1.20	1.64	1.60	2.19
NR	2.00	2.12	2.80	2.95
RN	3.20	3.70	1.40	3.13
RR	4.80	4.27	4.80	3.11

Source	df	SS	MS	F
Condition	3	63.48	21.16	1.66
Error	16	204.00	12.75	--
Time	1	.22	.22	--
Condition*Time	3	9.88	3.29	.04
Error	16	84.40	5.27	--

Social Interactions

Nine variables were analyzed in an effort to determine whether the four groups differed in the nature of their social interactions while playing the game. (Three of these focused on cooperative behaviors, while the other six examined possible negative effects of competition.)

Number of Instructional Events (Hypothesis 6)

An instructional event was defined as an instance of (a) coaching, (b) offering advice, or (c) sharing information with the apparent intent of improving a partner's ability to play the game. The summary of the results of the split plot analysis of variance for the number of instructional events appears in Table 11. The results show no significant differences among the groups. The means for three of the groups (NN, NR, RR) show more instructional events at time 1 than at time 2. In the RN condition, however, in which the reward was withdrawn, there were more instructional events at time 2. Total variance among the ratings which was due to differences among the conditions was estimated at 78%.

Instances of Interference (Hypothesis 7)

Interference was defined as any action or statement intended to annoy, distract or otherwise disrupt a partner's play. The summary of result for the split plot analysis of

TABLE 11

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of Instructional Events

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	2.20	2.68	1.60	1.52
NR	3.00	1.22	1.00	1.00
RN	.60	.55	1.00	1.73
RR	1.40	1.14	.20	.45

Source	df	SS	MS	F
Condition	3	13.28	4.43	1.55
Error	16	45.60	2.85	--
Time	1	2.56	7.23	5.35*
Condition*Time	3	7.68	2.56	1.90
Error	16	21.60	1.35	--

*$p \leq .05$; marginal means for Time 1 = 7.20, for Time 2 = 3.80

variance for instances of interference appears in Table 12. Results indicate that there were no significant differences among the groups in the number of instances of interference. Total variance among the ratings which was due to differences among conditions was estimated at 80%.

Number of "Look-at-Me" Statements (Hypothesis 8)

A look-at-me statement was recorded for each instance of a player (a) demanding attention or (b) seeking praise from his partner. These behaviors were typically accompanied by the statements "look at me" or "look at what I did," hence, the name of the variable. Table 13 shows the summary of the results of the analysis of variance for look-at-me statements. Because there was a significant condition × time interaction, simple effects were analyzed by making follow-up comparisons at time 1 and time 2. The results of follow-up comparisons are summarized in Table 14. Results indicate that there were sigificantly more look-at-me statements in the no-reward conditions at time 1. At time 2, when condition remained the same (NN, RR), this effect held true. Moreover, introduction of the reward corresponded to a significant decline in the number of look-at-me statements (NN vs. NR). Withdrawal of the reward, however, was not associated with a significant increase in look-at-me statements (RR vs. RN). The total variance among the ratings which was due to differences among conditions was estimated at 78%.

TABLE 12

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of Instances of Interference

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	2.40	2.30	2.60	2.40
NR	3.00	2.83	3.00	3.16
RN	2.60	1.82	1.80	1.48
RR	3.40	2.19	1.80	1.64

Source	df	SS	MS	F
Condition	3	3.28	1.09	.13
Error	16	134.00	8.38	--
Time	1	3.01	3.02	1.41
Condition*Time	3	5.07	1.69	.79
Error	16	34.40	2.15	--

TABLE 13

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of "Look-at-Me" Statements

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	7.60	5.02	7.00	2.24
NR	7.20	2.77	2.80	2.17
RN	2.60	1.82	4.60	1.14
RR	3.00	2.12	1.80	.84

Source	df	SS	MS	F
Condition	3	132.88	44.29	5.56*
Error	16	127.40	7.96	--
Time	1	11.02	11.02	2.14
Condition*Time	3	51.88	17.29	3.35*
Error	16	82.60	5.16	--

Time 1 vs. Time 1	df	SS	MS	F
NN	1	.90	.90	.17
NR	1	48.40	48.40	9.38*
RN	1	14.40	14.40	2.79
RR	1	3.60	3.60	.69

Condition	df	SS	MS	F
at Time 1	3	106.60	35.53	3.48*
at Time 2	3	78.15	26.05	8.91*

*$p \leq .05$

TABLE 14

Specific Comparisons for Number of "Look-at-Me" Statements

Comparison	Value of the Contrast	Standard Error
[a]Time 1		
NN + NR vs. RN + RR	9.20*	1.95
[b]Time 2		
NN vs. NR	4.20*	1.02
NN vs. RN	2.40	1.02
NN vs. RR	5.20*	1.02
NR vs. RN	-1.80	1.02
NR vs. RR	1.00	1.02
RN vs. RR	2.80	1.02

*$p \leq .05$

[a]Using Bonferroni t, which controls error rate per family.

[b]Using Tukey's procedure, which controls error rate per family.

Number of Arguments (Hypothesis 9)

An argument was recorded whenever players became involved in a prolonged disagreement over turns, scores, or rules of play. (Disagreements unrelated to the game were not recorded.) The split plot analysis of variance for number of arguments is summarized in Table 15. Results indicate that there were no differences among conditions for this variable. R2 for number of arguments and instances of interference was .19. Total variance among the ratings which was due to differences among conditons was estimated at 78%.

Instances of Praise (Hypothesis 10)

An instance of praise was recorded whenever a player voluntarily acknowledged or complemented his partner for good play. (Nonverbal behavior, such as applause, was included in this record.) Table 16 summarizes the results of the split plot analysis for instances of praise. Results indicate that there were no differences among the groups for this variable. Time, however, was a significant factor. For all groups, there were more instances of praise at time 1 than at time 2. R2 for praise and look-at-me statements was .41. Total variance among the ratings which was due to differences among conditions was estimated at 78%.

Instances of Encouragement (Hypothesis 11)

An instance of encouragement was recorded whenever a player made a comment intended to (a) console his partner

TABLE 15

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of Arguments

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	4.00	2.35	4.00	2.55
NR	3.00	1.58	4.60	2.88
RN	5.00	3.46	2.60	2.41
RR	5.40	2.07	4.60	1.82

Source	df	SS	MS	F
Condition	3	9.90	3.33	.48
Error	16	109.20	6.83	--
Time	1	1.60	1.60	.31
Condition*Time	3	20.80	6.93	1.33
Error	16	83.60	5.22	--

TABLE 16

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of Instances of Praise

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	2.20	2.28	1.40	1.14
NR	2.00	.71	.20	.45
RN	.60	.89	.60	.89
RR	.89	1.30	.40	.54

Source	df	SS	MS	F
Condition	3	9.67	3.22	2.37
Error	16	21.80	1.36	--
Time	1	5.62	5.62	4.21*
Condition*Time	3	4.48	1.49	1.12
Error	16	21.40	1.33	--

*$p \leq .05$; marginal means for Time 1 = 5.60, for Time 2 = 2.60

for poor play or (b) relieve his partner's frustration. The summary of results for the split plot analysis of variance for instances of encouragement appears in Table 17. Results indicate that there were no differences among the conditions in the number of instances of encouragement. Although one would expect the variables of praise and encouragement to correlate, R2 for these factors was only .04. Total variance among the ratings which was due to differences among the conditions was estimated at 39%.

Feelings of Frustration (Hypothesis 12)

Feelings of frustration with the game were assessed by items 2b, 8, 9, and 10 of the questionnaire (Appendix B). Responses were coded numerically to yield a combined score for teams. Subjects who said their experience with the game was "frustrating" received a higher score than subjects who described their experience as "carefree" (item 2). Subjects who reported feeling angry with their partner (item 10) received the highest frustration rating, followed by subjects who reported feeling angry with the game or with themselves (item 9), and, finally, by subjects who reported no anger (item 8). Table 18 summarizes the results of the split plot analysis of variance for feelings of frustration. Results indicate that there were no differences among the groups for this variable. An examination of the means, however, reveals a slightly higher average for the NN condition.

TABLE 17

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of Instances of Encouragement

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	1.20	1.30	.80	.84
NR	.84	.44	.40	.89
RN	.20	.45	.60	.89
RR	.40	.55	.20	.45

Source	df	SS	MS	F
Condition	3	2.87	.96	2.40
Error	16	6.40	.40	--
Time	1	.22	.22	.27
Condition*Time	3	1.07	.36	.43
Error	16	13.20	.82	--

TABLE 18

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Feelings of Frustration (Questions 2b, 8, 9, and 10)

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	4.20	1.48	3.90	.96
NR	4.70	1.60	3.70	1.87
RN	2.40	.65	2.60	1.08
RR	3.20	1.15	3.00	1.54

Source	df	SS	MS	F
Condition	3	19.47	6.49	2.22
Error	16	46.85	2.93	--
Time	1	1.05	1.05	1.54
Condition*Time	3	1.87	.62	.91
Error	16	10.95	.68	--

Number of References to Cheating (Hypothesis 13)

A reference to cheating was defined as any statement in which the word "cheat" was used in reference to playing the game. (Serious accusations of cheating were coded as arguments, and the content of the argument was described for the record.) Table 19 summarizes the results of the split plot analysis of variance for references to cheating. Because there was a significant condition × time interaction for time 2, simple effects were analyzed by means of follow-up comparisions. The results of the follow-up comparisons are summarized in Table 20. The results indicate that, while there were no differences among conditions at time 1, there were some differences at time 2. At time 2, there were more references to cheating in the no-reward condition (NN) than in the reward condition (RR), attributable both to a substantial increase in cheating references in the no-reward condition and to a decrease in cheating references in the reward condition from time 1 to time 2. There were also significantly fewer cheating references in the RN condition, where the reward was withdrawn, than in the NR condition, where the reward was introduced. Total variance among the ratings which was due to differences among conditions was estimated at 99%.

Instances of Cheating a Partner (Hypothesis 14)

An instance of cheating a partner was recorded whenever the experimenter saw a child (a) record an undeserved score

TABLE 19

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of References to Cheating

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	2.40	2.07	4.40	2.30
NR	3.60	3.44	2.80	2.17
RN	2.80	1.79	.60	.89
RR	4.60	2.70	2.20	1.79

Source	df	SS	MS	F
Condition	3	24.90	8.30	1.11
Error	16	120.00	7.50	-
Time	1	3.60	3.60	1.67
Condition*Time	3	33.00	11.00	5.12*
Error	16	34.40	2.15	-

Time 1 vs. Time 1	df	SS	MS	F
NN	1	10.00	10.00	4.65*
NR	1	.10	.10	.05
RN	1	12.10	12.10	5.63*
RR	1	14.40	14.40	6.70*

Condition	df	SS	MS	F
at Time 1	3	14.45	4.72	2.20
at Time 2	3	43.75	14.58	6.78

*$p \leq .05$

TABLE 20

Specific Comparisons for Number of References to Cheating

Comparison	Value of the Contrast	Standard Error
Time 1		
No specific comparisons were made; F = 2.20		
[a]Time 2		
NN vs. NR	1.60	1.74
NN vs. RN	3.80*	1.74
NN vs. RR	2.20*	1.74
NR vs. RN	2.20*	1.74
NR vs. RR	.60	1.74
RN vs. RR	-1.60	1.74

*$p \leq .05$

[a]Using Tukey's procedure, which controls error rate per family.

for himself when his partner was not watching or (b) claim a higher score than he actually earned on a match. The analysis for this variable is summarized in Table 21. While there were no significant differences among the groups, it is interesting to note the large drop in the mean for the RN group from time 1 to time 2. For every other group, there was an increase in the frequency of cheating a partner from time 1 to time 2. R2 for instances of cheating and amount of money earned was .32.

No formal hypothesis was put forth pertaining to the willingness of subjects to cheat the experimenter in order to win more money, because this phenomenon, by definition, was unique to the rewarded groups. Since this variable represents another type of cheating, however, it is mentioned here. Of the 15 groups which had the opportunity to win money by cheating, seven did so. Descriptive data relating to this variable are included in Chapter V.

Skill Development

Five variables pertained to the development of skill with the game. (One of these addressed the question of ability, while the other four were concerned with subjects' perceptions of the skill requirements of the game and their own competence with it).

TABLE 21

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Number of Instances of Cheating a Partner

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	.40	.55	.60	.89
NR	1.00	1.00	1.80	1.92
RN	1.40	2.19	.20	.45
RR	.60	1.34	1.60	1.34

Source	df	SS	MS	F
Condition	3	4.50	1.50	.66
Error	16	36.40	2.28	1.72
Time	1	.40	.40	--
Condition*Time	3	7.40	3.98	1.86
Error	16	21.20	1.32	--

Mean Scores on the Skill Test (Hypothesis 15)

Skill with the game was assessed by averaging an individual's scores across 15 trials, five trials per board during the postexperimental session. The results of the one-way analysis of variance for mean scores on the skill test are summarized in Table 22. The results indicate that there were no differences among the groups in skill. An examination of the means reveals slightly higher average scores in the NN condition.

Accuracy of Predictions on the Skill Test (Hypothesis 16)

An individual's ability to predict his success or failure over a series of trials during the skill test was taken as a measure of the individual's knowledge of his competence with the game. Accuracy of predictions was calculated as a percentage of correct predictions in response to the question "Will you get all the way through the maze on this try?" Table 23 summarizes the results of the one-way analysis of variance for accuracy of predictions. Results indicate that there were no differences among the groups in their ability to predict outcomes on the skill test. An examination of the means, however, shows a slightly higher average score for the NN group. R2 for accuracy of predictions and mean scores on the skill test was .23.

Ratings of Game Difficulty (Hypothesis 17)

Rating of game difficulty was assessed by analyzing responses to items 2c and 3 of the questionnaire (Appendix B).

TABLE 22

Means, Standard Deviations, and ANOVA Summary Table for Mean Scores on Skill Test

Condition	$\bar{X}$	S
NN	17.50	9.10
NR	13.10	6.70
RN	13.10	7.30
RR	15.00	8.80

Source	df	SS	MS	F
Model	3	130.48	43.49	.66
Error	36	2368.30	65.79	--

TABLE 23

Means, Standard Deviations, and ANOVA Summary Table for Accuracy of Predictions on the Skill Test

Condition	$\bar{X}$	S
NN	67.90	19.40
NR	59.00	19.60
RN	50.70	19.60
RR	57.50	23.89

Source	df	SS	MS	F
Model	3	1501.48	500.49	1.16
Error	36	15493.50	430.38	--

Responses were coded numerically and averaged to yield a combined score for each team. Subjects who reported that their experience with the game was "difficult" and "complicated" received the highest score. Subjects who chose the descriptors "easy" and "simple" received the lowest score. The summary of the results of the split plot analysis of variance for ratings of game difficulty is presented in Table 24. The results indicate that there were no differences among the groups.

Expressions of Skill Requirements of the Game (Hypothesis 18)

Expressions of skill requirements were measured by responses to items 6, 7, and 15 on the questionnaire (Appendix B). Responses were coded numerically and averaged to yield a combined score for team. For item 6, subjects who responded by saying "a lot" of skill was involved in playing the game received the highest score. For item 7, the highest score was given to subjects who said "none" when asked how much luck was involved. For item 15, responses were summarized and rated according to the amount of skill required by the strategies mentioned. Strategies requiring a high degree of skill (e.g., "rest in the corners," "stay close to the wood") were assigned higher ratings than strategies requiring little or no skill (e.g., "try hard," "skip over hard parts"). Table 25 summarizes the results

TABLE 24

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Ratings of Game Difficulty (Questions 2c and 2e)

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	2.90	.74	3.00	.61
NR	3.00	.79	2.60	.65
RN	3.00	.93	3.10	.81
RR	2.50	.50	2.70	.45

Source	df	SS	MS	F
Condition	3	1.15	.38	.42
Error	16	14.70	.92	--
Time	1	--	--	--
Condition*Time	3	.55	.18	1.73
Error	16	1.70	.11	--

TABLE 25

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Expression of Skill Requirements of the Game (Questions 6, 7, and 15)

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	5.20	.75	4.40	1.08
NR	4.20	1.60	3.20	1.48
RN	3.70	1.15	3.60	.82
RR	3.70	.83	4.00	1.00

Source	df	SS	MS	F
Condition	3	8.75	2.92	1.38
Error	16	33.75	2.11	--
Time	1	1.60	1.60	3.58
Condition*Time	3	2.75	.92	2.05
Error	16	7.15	.45	--

of the split plot analysis of variance for expression of skill requirements. Results indicate that the groups did not differ on this variable. The means indicate that there was a slight tendency for the NN subjects to express skill more often than other subjects, particularly at time 1. R2 for expression of skill requirements and ratings of game difficulty was .12.

Internality of Attributions (Hypothesis 19)

Internality of attributions for winning or losing was measured by responses to items 12 and 13 of the questionnaire (Appendix B). Responses were coded numerically and averaged to yield a combined score for team. Subjects who attributed winning or losing to effort or lack of effort in item 12 received the higher score. For item 13, subjects attributing wins or losses to practice or lack of practice received the higher score. The summary of results for the split plot analysis of variance for internality of attributions appears in Table 26. The results indicate that there were no significant differences among the groups for this variable. Time, however, was a factor. All groups were more internal in their attributions at time 2 than they were at time 1. R2 for internality of attributions and rating of game difficulty was .17.

TABLE 26

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Internality of Attributions for Winning or Losing (Questions 12 and 13)

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	3.50	.50	3.80	.27
NR	3.20	.45	3.40	.42
RN	3.10	.42	3.20	.57
RR	3.00	.61	3.60	.42

Source	df	SS	MS	F
Condition	3	1.35	.45	1.44
Error	16	5.00	.31	--
Time	1	.90	.90	7.20*
Condition*Time	3	.35	.11	.93
Error	16	2.00	.13	--

*$p \leq .05$; marginal means for Time 1 = 12.8, for Time 2 = 14.0

Interest

Three variables addressed the question of whether groups would differ in their interest for the game. (The first of these focused upon subjects' ratings of the game as enjoyable. The second attempted to assess the degree to which the game's competitive affordance was a factor in subjects' enjoyment of the game. Finally, the willingness of subjects to reengage the game, when there was no external pressure to do so, served as a behavioral measure of interest.)

Expressed Liking of the Game (Hypotheses 20)

Liking of the game was assessed by responses to items 2a and d, 3, and 14 of the questionnaire (Appendix B). Responses were coded numerically and averaged to yield a combined score for team. For item 2, subjects who responded that the game was "interesting" rather than "boring" and more like "play" than "work" received the highest score. For item 3, the number on the rating scale chosen by the subject became his score. For item 14, subjects who said "yes" they would be willing to come after school or on a holiday to play the game received the highest score. Table 27 summarizes the results of the split plot analysis of variance for these responses. The results indicate that groups did not differ in their expressed liking of the game. R2 for liking of the game and ratings of game difficulty was .13.

TABLE 27

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Expressed Liking of the Game (Questions 2a and 2d, 3, and 14)

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	12.40	.74	12.90	.96
NR	12.60	1.19	13.20	1.03
RN	13.10	.65	12.80	.67
RR	12.80	1.15	12.90	1.34

Source	df	SS	MS	F
Condition	3	.52	.17	.11
Error	16	26.05	1.63	--
Time	1	.51	.51	1.38
Condition*Time	3	1.27	.42	1.16
Error	16	5.85	.37	--

Importance Placed on Competition (Hypothesis 21)

Importance placed on competition was assessed by responses to items 5 and 11 of the questionnaire (Appendix B). Responses were coded numerically to yield a combined score. For item 5, subjects who said the game was more fun when they played it with a partner received the higher score. For item 11, subjects who responded "yes" when asked if they would like the game more if they had won more matches were given the higher score. Table 28 summarizes the results of the split plot analysis of variance for importance placed on competition. The results indicate a significant main effect of condition. Follow-up comparisons on this main effect are summarized in Table 29. Subjects in the reward conditions (NR, RN, RR) placed more importance on competition than subjects in the no-reward condition (NN).

Reengagement (Hypothesis 22)

Reengagement was tested by analyzing the amount of time subjects spent playing the game during the 5-minute free-choice period. The summary of the results of the one-way analysis of variance for reengagement is presented in Table 30. The results indicate that there were significant differences among the groups. Follow-up comparisions, summarized in Table 31, indicate that the NN group spent significantly more time playing the game during the free-choice period than any of the other groups.

TABLE 28

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Importance Placed on Competition (Questions 5 and 11)

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	2.30	.27	2.10	.22
NR	4.20	1.60	3.20	1.48
RN	3.70	1.15	3.60	.82
RR	3.70	.84	3.40	.42

Source	df	SS	MS	F
Condition	3	8.82	2.94	11.61*
Error	16	4.05	.25	--
Time	1	.30	.30	2.51
Condition*Time	3	.62	.20	1.69
Error	16	1.95	.12	--

*$p \leq .05$

TABLE 29

Specific Comparisons for the Importance Placed on Competition: Main Effect of Condition

Comparison	Value of the Contrast	Standard Error
[a]NN vs. NR	-1.50*	.155
NN vs. RN	-1.45*	.155
NN vs. RR	-1.35*	.155
NR vs. RN	.05	.155
NR vs. RR	.15	.155
RN vs. RR	.10	.155

*$p \leq .05$

[a]Using Tukey's procedure, which controls error rate per family.

TABLE 30

Means, Standard Deviations, and ANOVA Summary Table for Reengagement of the Game

Condition	$\bar{X}$	S
NN	4.80	.63
NR	1.90	2.11
RN	2.55	1.99
RR	3.10	2.32

Source	df	SS	MS	F
Model	3	46.32	15.44	4.34*
Error	36	128.13	3.55	--

*$p \leq .05$

TABLE 31

Specific Comparisons for Reengagement of the Game

Comparison	Value of the Contrast	Standard Error
[a]NN vs. NR	2.90*	.844
NN vs. RN	2.25*	.844
NN vs. RR	1.70*	.844
NR vs. RN	- .65	.844
NR vs. RR	-1.20	.844
RN vs. RR	.55	.844
[b]NN + NR vs. RN + RR	3.45*	1.19

*$p \leq .05$

[a]Using Tukey's procedure, which controls error rate per family.

[b]Using Bonferroni t, which controls error rate per family.

Summary of Results

Twenty-two variables were tested in this study. No differences among groups were found for 15 of the tests. Seven tests revealed statistically significant differences among experimental conditions. Five variables pertained to the learning process. Of these, no significant differences were found on measures of Board Difficulty and Employment of Minimax Strategies. However, there were significant differences among the groups in the Percentage of Intervals Containing Matches, the Amount of Practice Time Preceding the First Match of the session, and the Percentage of Engaged Time.

Nine variables related to the nature of social interactions between partners. No significant differences were found among groups on seven of these: Number of Instructional Events, instances of Interference, number of Arguments, instances of Praise, instances of Encouragement, Feelings of Frustration, and instances of Cheating a Partner. Time was a significant factor for the variable of Praise, there being more instances of Praise for all groups at time 1 than at time 2. There were significant differences among the groups in the number of Look-at-Me Statements and the number of References to Cheating.

Five variables related to aspects of skill developement: Mean scores on the Skill Test, Accuracy of Predictions of outcomes on the skill test, Ratings of Game Difficulty,

Expressions of Skill Requirements of the game, and Internality of Attributions. There were no significant differences among the groups on any of these variables. Time was a significant factor for Internality of Attributions, all groups being more internal in their attributions for winning and losing at time 2 than at time 1.

Three variables pertained to interest in the game. There were no differences among the groups in their Expressed Liking of the game. There were significant differences, however, in the Importance Placed on Competition and Reengagement of the game. Possible interpretations of these results, along with descriptive data relating to the interpretations, are presented in Chapter V.

CHAPTER V

DISCUSSION AND IMPLICATIONS OF THE RESEARCH

Introduction

The present study questioned whether a contrived reinforcer would influence learning process, skill development, social interactions, and attitudes of children toward a learning activity in a setting which made salient the ecological rewards of that activity. The guiding premise of the investigation was that, when ecological rewards are in place, contrived rewards are unnecessary to motivate learning and may even be detrimental. In this chapter, the major findings of the study are presented, followed by the researcher's interpretation of these findings. Finally, the implications of the study for education and educational research are discussed.

Major Results

Of the twenty-two tests of hypotheses in the study, seven revealed significant differences among the experimental groups. Five of these tests revealed differences in the direction predicted by the research hypothesis, while

two uncovered differences which ran contrary to predictions. The major results of the investigation were as follows:

1. The reinforcement contingency increased the frequency of the rewarded response, i.e., competition. Subjects were reinforced each time they won a match on a maze game called Labyrinth. Subjects who were reinforced for competition spent about twice as much time playing matches as subjects who were not reinforced for competition.

2. Reinforcement for competition reduced the amount of time subjects spent practicing prior to beginning match play. Subjects who were not reinforced for playing matches practiced an average of 20 minutes prior to playing the first match of a session, while subjects who were paid for each match they won averaged only 13 minutes of prior practice.

3. Reinforcement for competition reduced the percentage of time subjects spent actually engaged in playing the game.

4. The reinforcement contingency did not significantly alter subjects' social interactions during play. Only two of the nine measures of social interaction revealed any significant differences among experimental groups, and these differences ran contrary to predictions. Look-at-Me Statements, a measure of boastfulness, were somewhat more prevalent among no-reward groups, but this effect was inconsistent across conditions.

5. Reinforcement for competition did not affect skill development.

6. Subjects who had been reinforced at any time for competition were less likely to reengage the game a week later than subjects who had never been reinforced for competing. This was so in spite of the fact that all subjects said they liked the game equally well.

7. Subjects who had been reinforced at any time for competition, as opposed to subjects who had never been reinforced, were more likely to say that competition and winning were important factors in their enjoyment of the game.

Interpretation of Results

These findings suggest some important general questions. First, why were learning process variables related to the use of time affected by the reinforcement contingency while those variables related to effort, exploration, and challenge were not? Second, why were subjects in the ecological (no-reward) groups more prone to boastfulness and statements about cheating? Third, why were measures of skill development unaffected by the reinforcement contingency? Finally, why did the contrived reinforcer reduce subjects' willingness to reengage the game when it did not affect how much they said they liked the game?

The answers to these questions are closely tied to the design and purpose of the investigation. The present study set out to test the influence of a contrived reinforcer in an ecological setting. Another way of stating this would be to say that the research examined the strength or influence of a contrived reward relative to that of ecological rewards in the same environment. Recall that the experimental setting was designed to make salient the ecological rewards of learning to play a game of skill. Children were told that their task was to evaluate the game. Although they were never told to learn anything specific, children, no doubt, understood that an evaluation implied some learning, or, at least, an informed judgment on their part. Thus, the stage was set for children to do the kind and amount of learning which they felt necessary to give their opinion of the game's worth. Children were also given the opportunity to compete with one another. This opportunity further implied the development of some skill with the game. While partners were free to set their own level of competition, winning required an individual to develop more skill at a given level than his opponent.

Within the ecological conditions, then, the growth or development afforded by practice and competition comprised the only source of reinforcement. In the contrived conditions, however, another source of reinforcement was introduced. Children were paid a dime each time they won

a match against their partner. Now, instead of there being a purely structural link between the act of winning a match and the consequence of knowing something about one's skill, there was also an arbitrary link--the receipt of a valuable reward. In interpreting the results of the present study, the central issue is whether this arbitrary link was able to take control away from the structural one. If so, why, and to what extent? And was the effect of this arbitrary control of any particular benefit or detriment to the learning experience of the children involved? Each of the questions raised earlier is now addressed in these terms.

Learning Process

Only the learning process variables related to the use of time were affected by the contrived reward. Subjects who were paid for winning matches played more matches and began playing matches earlier in the session. But they spent a smaller percentage of their time engaged in playing the game. In these cases, the arbitrary link between winning matches and winning money apparently exerted greater control than the structural link. When there was no external pressure to play matches, subjects spent less time competing and more time practicing prior to competing. When these children played their first match it seemed to be because they had reached a level of mastery which made

them want to test their skill against that of their partner. This can be seen in the type of comments which preceded matches in the no-reward groups:

Team 1: "Let's have a race."

Team 2: "I bet I can beat (you) best out of ten."

Team 3: "Let's play on board 2, we need the practice on that one."

Compare these comments to some of those preceding matches played by the reward groups:

Team 9: "Now let's win some money."

Team 11: Subject 1: "This (board 1) is boring. Let's do this one (board 3.)" Subject 2: "No, I'll start losing money."

Team 15: "Come on. We're wasting time."

When the profit motive controlled the learning process, time became equivalent to money, as it did for subjects in the Chambers study (1979). Spending time practicing was wasteful, so long as there was at least an even chance that one could win a match without practice. It may have been this realization which led one reward subject to observe, "This is like gambling."

The increased competition among reward subjects also led to a decrease in the overall amount of time engaged in play. In reward groups, most nonengaged time was spent watching a partner play, keeping score, discussing rules or turns, and discussing how much money had been won or what

should be done with it. One team spent a total of 20 minutes counting their coins, comparing dates, and discussing how the money could be spent. This stands in contrast to the no-reward groups, where the bulk of nonengaged time was spent discussing matters unrelated to the game (e.g., sports, friends, and school events) and exploring the experimental room, which housed the schools photographic archives and an array of photographic tools.

The reason for this difference appears to stem from the fact that the reward controlled, not only the amount of competition, but also the way competition was conducted. In the no-reward groups, partners typically played simultaneously and recorded their scores individually. When a question of accuracy of the score arose, there was usually an accusation of cheating, followed by an argument that was resolved by one partner giving in to the other. When this pattern occurred once, it usually occurred several times during the session. In the reward groups the pattern was similar, but the resolution was different. Usually, the argument was resolved by the players deciding to take turns so that each person could verify the other's scores. This did not always solve the problem, however. In some reward groups, one of the players became so suspicious of the other's honesty that he insisted not only on watching

the person play, but also on keeping both scores. Needless to say, these activities reduced engaged time considerably.

Although the reinforcement contingency altered the way subjects used their time, it did not seem to have a significant effect on other process variables. The difficulty level of boards used during play and the way practice was distributed across the boards was about the same for all groups. Apparently the emphasis on competition did not mask the fact that board 1 was too easy and board 3 was too hard for most subjects. In fact, several teams discussed this fact while they played. One boy observed of board 2, "It's hard enough to be fun." The no-reward groups, whose choice of difficulty level, we must assume, was based on the developmental affordance of the boards, played on board 2 most of the time, just as the reward groups did. Even if the reward groups were not motivated primarily by a desire for mastery (as their reduced practice time and engaged time would suggest), it must have been apparent to them that board 2 afforded them a better chance in competition than either board 1 or board 3. Most subjects were able to master board 1 within the first half hour so that competing on this board meant repeatedly tieing matches. Subjects had the opposite problem with board 3, but the effect was the same. Board 3 was so difficult that few children were ever able to get beyond

the third or fourth hole. In competition, again, this meant tieing matches. Thus, board 2 was used most frequently, because it was easy enough to make winning possible, but difficult enough to keep the outcome from being known ahead of time.

The lack of differences among the groups in their tendency to employ minimax strategies presents an interesting problem. This variable was taken as a measure of the degree to which subjects would minimize challenge and effort in their attempt to maximize scores and/or profits. The three behaviors which were recorded as Mimimax were (a) making a rule that finishing a maze was equivalent to winning a match, (b) counting intentional or accidental shortcuts through the maze, and (c) agreeing that the first person to drop in a hole was the loser, regardless of the other person's position at the time. Intuition and evidence from related research (Chambers, 1979; Lepper, Greene, and Nisbett, 1973) would suggest that subjects who were motivated by profit would have reason to use such strategies, whereas subjects working in the interest of mastery would not. In interpreting the lack of differences, two possible explanations come to mind. It may be that the target behaviors were simply not appropriate measures of the tendency to minimize effort in order to maximize profit. This explanation would be acceptable if it were not for the substantial correlation (.48) between Minimax and the amount

of Pay received. These measures together accounted for 20% of the variance among groups. Therefore, it would not be wise to dismiss Minimax altogether.

Another possible explanation is that the groups used these strategies equally, but for different reasons. Some evidence for this rests on the fact that of all the instances of Mimimax which were recorded in the ecological conditions, only 30% of them occurred while subjects were actually recording their scores. (Frequently in the no-reward groups, subjects played what they called "rounds" or "races," and kept only a verbal account of their performance.) By contrast, 78% of the minimax strategies recorded in the contrived condition occurred while scores were being tallied. Apparently, when no-reward subjects used these strategies, it was not soley in the interest of improving their scores. Among no-reward groups, the most prevalent Minimax stragegy was shortcutting across hole 2/12 on board 2, allowing the player to circumvent ten holes (two of which were, by most accounts, the toughest holes on that board). For some children, mastering this "trick" became an end in itself. The interesting thing to note is that when this rather dubious achievement caught the attention of one team member, it usually became a challenge for both players. One no-reward team had a contest to see who could skip over hole 2/12 the most times before falling in.

The most prevalent minimax strategy among reward groups was making the rule that finishing the maze was equivalent to winning the match. In one sense this strategy could be viewed as a way of increasing effort, rather than minimizing it, since it required a person to negotiate the entire maze in order to win. When one examines where the strategy was used, however, it becomes clear that subjects were indeed minimizing both effort and competition by this rule. In virtually every case where the "finish-equals-win" rule was invoked by the partners, they were playing on a board they had already mastered, usually board 1. Thus, finishing the maze was not a challenge for the players. In some cases, the discussion which accompanied the making of this rule revealed the subjects' motives. An interesting and representative example comes from Team 11 (playing on board 1):

Subject 1: "I won that one."

Subject 2: "But I haven't had my turn.

Subject 1: "Okay."

Subject 2: (Takes his turn and finishes the maze) "I won."

Subject 1: "No!"

Subject 2: "We both won."

Subject 1: "Okay, we won't compete. Just see how much money we win."

Following a series of events almost identical to those above, Team 15 (playing on board 1) had this to say:

Subject 2: "Now that we're not competing, this is a lot easier."

Subject 1: "And more fun."

In these groups, the product of competition had become more important than the process; that is, getting the reward was more important than earning it. Of course, this was true for other groups also. But their strategies for dealing with it were sometimes different. Some of these other strategies will be mentioned in the discussion on social interactions.

Social Interactions

Only two of the nine variables relating to social interactions were found to be significantly different among groups, and these differences were surprising. Contrary to expectations, subjects in the no-reward conditions tended to be more boastful during play and to make references to cheating more frequently than subjects in the reward conditions. The expectation was that in the ecological condition, an atmosphere of "friendly competition" would prevail because the reward for competition would be largely developmental. If one were competing in order to test his skill, it would not behoove him to attempt "winning by

intimidation." But when the act of winning was arbitrarily linked to a valued reward, and winning became more important than developing skill, bragging, accusing an opponent of cheating, or using other "unfriendly" techniques might serve a purpose.

In general, the increased competition among reward groups did not have the negative effect on children's social interactions that was anticipated. In fact, where negative behaviors were observed, they were in the no-reward groups. However, a close inspection of the original data suggests that the quantitative differences in boastfulness (Look-at-Me Statements) and References to Cheating may not tell the whole story. When one examines the contexts of Look-at-Me Statements, one finds that in the no-reward groups, only 20% of these statements occurred within the context of competition. On the other hand, 53% of the Look-at-Me Statements generated by reward groups occurred while matches were being played. One might infer from this that Look-at-Me Statements served somewhat different purposes in the two groups. It is quite possible that boasting was used to supplant competition in the no-reward groups. Perhaps it was a way for the players to compare their skill without actually engaging in a match. Correlations between this variable and other measures of social interaction suggests that this may, indeed, be the case. Look-at-Me Statements correlated substantially with Praise (.64) and Instructional Events (.33),

measures of friendly competition, while they correlated negatively with Arguments (-.14) and the amount of Pay received (-.50) (see Appendix D, Table A-2). This may mean that Look-at-Me Statements in the no-reward groups represented something more than boastfulness, and something more like friendly than unfriendly competition.

In the same way, References to Cheating might be interpreted in light of the context within which they occurred. Here, again, 23% of the References to Cheating in the no-reward groups occurred within the context of match play, compared to 71% in reward groups. Moreover, when Arguments About Cheating were analyzed apart from other arguments, a difference was found among the groups which was not captured in the primary analysis. To conduct a separate analysis, the descriptive record of arguments was examined and only those arguments which resulted from a serious accusation of cheating were analyzed. The results of the 2 × 4 split plot analysis of variance appears in Appendix E, Table A-4. The results indicated that there was a significant condition × time interaction. Results of the follow-up comparisions (see Appendix E, Table A-5) show that no-reward groups had fewer Arguments About Cheating at Time 1. The effect was not significant for Time 2. However, the means for the NR and RN groups reveal a significant increase in Arguments About Cheating when the reward was introduced, and a significant decrease when the reward was withdrawn.

The inference that might be drawn from this is that what is said is not so important as the context in which it is said. In no-reward groups, References to Cheating usually occurred outside the context of competition, and, therefore, they created no antagonism. Within the context of competition, however, there was apparently a tendency of subjects to become defensive when such comments were made.

The overall lack of differences among the groups in the nature of their social interactions is very encouraging. It suggests, in general, that the emphasis on competition in reward groups did not produce unfriendly relationships between partners. Children in these groups did not argue or interfere with each other's play more than children in the no-reward groups. Moreover, they were just as likely to offer instruction, praise, and encouragement to their partners, and they did not feel any more frustration or anger while playing the game. In the researcher's opinion, this speaks well for the maturity and intelligence of these children. Furthermore, it suggests that the instrumental orientation toward peers which was found in the Garbarino study (1975) may not be a necessary result of contrived rewards. The present study indicates that when children have a choice between viewing a peer simply as a means to an end or viewing him as a partner and co-worker, they may choose the latter.

Of course, this partnership between players was not always a noble one. In some cases, partners in reward groups conspired to cheat the experimenter. While reward teams were no more likely to cheat each other than no-reward teams, about half of them, 7 out of 15, were willing to cheat "the anonymous other" in order to win more money. In all the cases where this happened, teammates falsified their score-cards in order that their winnings would be equal. In fact, the reason for the conspiracy was always that one partner was winning more than the other. In five of the seven cases, it was the winning partner who made the suggestion to "fake it" because he could see that his teammate was becoming angry and frustrated by failure. The following dialogue from Team 6 is representative. The children were in the NR group and this conversation occurred about half way through the second session. Subject 2 has not won any money so far.

Subject 2: "Why do we have to do this for money?"

Subject 1: "I like that."

Subject 2: "That's because you're good at it."

Subject 1: "You can win some." (He takes the score-card and begins making marks in Subject 2's column. Subject 2 catches on and leans over to look at the card.)

Subject 2: (Whispers something unintelligible.)

Subject 1: "Okay, I'll give you some more." (He makes some more marks.)

Subject 2: (Takes the card and makes more marks for himself.)

Subject 1: "Don't make it too obvious." (He inspects the card and erases a few marks.) "That's the most we can get. Now, let's play for fun."

Subject 2: (Inspects the card and seems satisfied.)

The children played individually until E returned and made a payoff, after which their engaged time dropped dramatically. For the remaining 30 minutes of the session, they were never engaged in playing the game for more than two or three minutes at a time.

Perhaps this phenomenon has some cultural basis. People who would not think of stealing so much as a clothespin from a neighbor will cheat on their taxes, and the same man who would never take credit for an undeserved golf score will falsify his expense account. Many people seem to accept this double standard and live by it to some degree in their own lives. Rather than being a result of culture, however, this double standard is more likely a result of different reward structures. Working for ecological rewards, which are structually inseparable from the activities through which they are earned, makes falsification meaningless. The golfer does not play better golf because his scorecard looks impressive. On the other hand, contrived rewards may not only be separate from but irrelevant to the demands of an activity. In the present

experiment, for example, winning money seemed, for some subjects, to have nothing to do with playing the game. Thus, falsification became a meaningful strategy. It meant that one could secure a valued reward and then get down to the real business of playing the game for "fun." Hence, the difference between the profit motive and the mastery motive.

Skill Development

Reinforcement for competition did not significantly affect the amount of skill subjects developed. All the children mastered board 1. More than half mastered board 2. Several children developed a fair amount of skill on board 3. Viewed in one way this result may suggest that working for a contrived reward is not beneficial to skill development within an ecological setting. Given that the researcher paid out over $60.00 in dimes to reward subjects without significantly improving their ability to play the game, one could say that the reward contingency was not really cost effective. However, there was no reason to believe that the contrived reward, in and of itself, would facilitate skill development. Subjects were not rewarded for mastering the game to a certain criterion. If they had been, the result may have been different.

The present study did not expect to show facilitative effects of contrived rewards. The prediction was that the

no-reward subjects would develop more skill. This prediction was based upon predictions regarding the learning process. It was expected that more individual practice, more overall engaged time, and working with boards of higher difficulty would improve the skill of no-reward subjects. A higher degree of skill was expected to show forth in the individual's awareness of his own competence, his knowledge of the game's skill requirements, and his tendency to attribute his success or failure during competition to his own actions and efforts. This was not the case, however.

One explanation for the lack of differences among groups would be that the ecological rewards of mastering the game were not sufficient to produce effort or achievement. This argument would be convincing if it were not for the fact that so many of the subjects developed proficiency with a difficult task in a relatively short time. A more tenable explanation is that the reward contingency did not prevent achievement, that is, it did not mask the ecological demands of the activity. Although the arbitrary link between competition and money was salient, as the increased competition among reward subjects would suggest, it apparently did not overshadow the structural link between competition and learning about one's skill with the activity. Whether they were playing for money or not, children were able to see the coherence between their efforts

and their ability to play the game. They were able to use feedback within the activity to improve their skill. And, they were able to discern the skill requirements of the game in spite of the fact that they may have chosen to side-step those requirements during competition (e.g., using shortcuts to make play faster). Thus, while working for a contrived reward in an ecological setting was not of any particular benefit to skill development, it was also of no particular detriment. Perhaps the best that can be said is that the reward was simply unnecessary.

Interest

Differences among groups were found on two measures of interest. The more important of these was Reengagement, the behavioral measure of subsequent interest in the game. The other significant difference was in the Importance Placed on Competition. While in and of itself not very intriguing, this difference may help to explain why rewarded subjects who said they liked the game as well as nonrewarded subjects were not as eager to reengage it a week later.

Loss of subsequent interest has been the most frequent finding of research studies in this field (Harlow, 1950; Deci, 1971; Lepper, Greene, and Nisbett, 1973). The present study seems to confirm the notion that contrived rewards

act as attention focusing elements of the motivational context (Kruglanski, Friedman, and Zeevi, 1971; Condry, 1975).

In the ecological (no-reward) condition, the consequences of competition were always skill development, challenge, "fun," or some other personal affordance. These consequences were structurally linked to act of playing the game. Playing the game was always an ecologically meaningful act, in the sense that the meaning of play derived from the context of activity. Competition was just another way of playing. No-reward subjects also devised some interesting cooperative methods of play. For example, one team put both balls on the same game and worked together (one person turning one knob while the other person turned the other knob) to get the balls through the maze. They even kept a team score and made "team spirit" remarks like "We really blew it that time," and "We're almost there." For these subjects, the process of playing the game and the products of play were of a piece. Whether playing competitively, cooperatively, or individually, their attention was always focused upon the personal affordance of play.

In the contrived (reward) conditions, however, reinforcement for competition set up an arbitrary link between playing the game and winning money. The act of playing the game became instrumental to securing a valued reward. There was a consequence of play separate from and irrelevant to the structural or ecological consequences of play. It is possible that subjects whose attention was focused primarily

upon the arbitrary consequence of winning money failed to attend to the ecological consequences of play, i.e., skill development, challenge, fun, and the like. While rewarded subjects did not consciously devalue the activity, they apparently attached less personal meaning to it. With so much attention focused upon the game's competitive affordance, perhaps they simply overlooked its personal affordance.

One problem in interpreting the findings on Reengagement in this study should be noted. The RR groups had always played the game under contrived conditions, in which competitive play was associated with monetary reward. The conditions of reengagement removed not only the reward, but also the possibility for competition. Therefore, in the RR groups, the findings on reengagement are somewhat confounded, in that the effect of removing the reward cannot be separated from the effect of removing competition. In all of the other conditions (NN, NR, RN), subjects had the opportunity to compete under ecological conditions, and, therefore, to experience the personal or developmental affordance of competitive play. When these subjects reengaged the game in the absence of the contrived reward, the ecological rewards derived from competition were still in place and able to take over. However, for the RR subjects, competition had become synonymous with the contrived reward. To remove the reward was also to remove the primary affordance

of the game. Thus, whether or not it was specifically the removal of the reward or the removal of the game's competitive afforance which reduced reengaged time for RR subjects is impossible to determine based on the present data.

Nevertheless, this seems to be the most general consequence of contrived material rewards--that they are able to divert attention away from the ecological rewards of learning. What does it mean to learn something without seeing its ecological significance? If one learns to play an instrument without having a personal sense of creating music, what of value has been learned? If school children can be made to recite a poem without hearing the beauty of poetry, what have they accomplished? Surely, in the richest sense of learning, the music and the beauty are as important as the playing and reciting. If not, the act has been accomplished without an understanding of what the act means. When this is the case, learning, in the sense of knowing something about oneself in the world, cannot be said to have occurred. And if what is learned teaches one nothing about oneself, it is unlikely that the learning will last or the person will want to return to the activity.

Implications

What does the present study suggest about our children and our schools? First of all, it suggests that the assumptions about learning put forth in Chapter I are correct. Left to themselves in an environment which is coherent, responsive, and engaging, children can and will manage their own learning. Furthermore, it suggests that when the environment offers ecological rewards, contrived rewards are unnecessary to motivate learning and may have certain undesirable "side effects."

In the present study, children showed that they were able to interpret the demands of a skilled activity and work progressively toward competence with the activity in the absence of external pressure or formal instruction. Most of them displayed a high degree of maturity in their social interactions with one another. They developed a sense of their own competence, based solely upon feedback inherent in the activity, which improved in proportion to their skill. Placed in a setting where the ecological demands for learning were salient, children tended to respond willingly and intelligently to those demands. When a contrived reward was introduced into the setting, children were, indeed, distracted by it. While learning outcomes were not seriously affected, children did suffer a loss of interest for reengaging the activity in the absence of the reward. Perhaps, the most telling observation that can be made regarding

the use of a contrived reward in an ecological learning environment is that so many of the children seemed genuinely perplexed as to its purpose: "Why do we have to do this for money?" Indeed, when one is given a meaningful world to discover, explore, and learn about, why should there be any need for contrivance?

This brings us to the question of why schools so often resort to the use of artificial inducements--grades, tokens, awards, detentions, corporal punishment--to encourage learning. It is probably because schools, by and large, have not found ways to create meaningful worlds for their students to learn about. Consider the differences between the learning environment in the present study and the learning environment of most schools. In this experiment, children were engaged in an activity which was initially interesting and attractive to them. They were placed in a situation where learning was implied by environmental features but was never required. Finally, they were free to direct their own learning process. Contrast these features with those of the typical school setting. Children are frequently engaged in activities which seem initially uninteresting if not distasteful. The express purpose of their activities is learning, and very specific types of learning are required of them. Finally, the process by which they learn is controlled and directed largely by forces external to actual task demands, e.g., teacher

directions, workbook formats, etc. These differences stem from the fact that learning in schools is decontextualized, while learning in the present study (as in the world) was contextual. Without a meaningful context, children cannot see the purpose of learning something until after it has been learned. Therefore, teachers find it useful to create arbitrary purposes for learning. Moreover, when there are no contextual clues to guide them, children have no way of directing their own learning process. Hence, the necessity for supplying them with artifical guidelines. In The Child and the Curriculum, Dewey writes:

> If the subject matter of the lessons be such as to have an appropriate place within the expanding conciousness of the child, if it grows out of his own past doings, thinkings, sufferings, and receptivities, then no device or trick of method has to be resorted to in order to enlist "interest." . . . But the externally presented material, that conceived and generated in standpoints and attitudes remote from the child, and developed in motives alien to him, has no such place of its own. Hence, the recourse to adventitious leverage to push it in, to factitious drill to drive it in, to artifical bribe to lure it in." (Dewey, 1902, p. 108)

The results of the present study have implications which point in two directions for schools. The first course would have schools remain basically unchanged. Schools would continue to regard as their primary mission teaching children things which they would not learn without some goading. Schools would accept the notion that children do not always see why they need to learn certain things and bolster

themselves to the task of using incentives in order to produce the greatest achievement.

If schools continue to operate on this premise, they should acknowledge the following implications of the present research. First, a reinforcement contingency will increase the frequency of the rewarded response, often leaving peripheral behaviors unaffected. This suggests that teachers must be thoughtful in attaching rewards to the behaviors they really want to increase. The teacher who wants to improve a student's reading ability, for example, would be unwise in taking the obvious and easy course of reinforcing the student for the number of books read. Instead, the reward should be made contingent upon the quality and difficulty level of the books, as well as upon the student's comprehension of the material. In schools, one often finds that expressed learning goals are not supported by the implications of the reward system. When a teacher states as the purpose of an American History class that it is intended to increase the student's appreciation of the historical significance of the Civil War, and then the teacher writes examination questions which call only for rote memorization of isolated facts concerning the war, that teacher has set up a reward system which will not support the expressed purpose of his or her teaching. But this is what happens all too frequently, because the dispensation of material rewards requires that the teacher measure,

quantify, and rank proficiencies to which the rewards can be attached. Thus, in spite of all that we may say or hope about the intangible goals of education (i.e., appreciation, awareness, understanding, etc.), our reward structure dictates that these intangibles take a back seat to the more easily quantifiable goals upon which we base our grades and promotions.

Another finding of the present study which has implications for schools is that the presence of rewards makes cheating possible. When a valuable material reward is at stake, some people will see getting the reward as more important than earning the reward. And the further removed a contrived reward becomes from the ecological demands of an activity, the more easily can cheating be justified on purely pragmatic grounds. The degree to which a person will cheat, or falsify work, in order to get a contrived reward will depend on a number of factors: the value of the reward, the person's history, peer approval, opportunity, and so forth. The important point is that the presence of a contrived reinforcer makes falsification a meaningful event. A behavior which is considered undesirable, even immoral, is made useful by an arbitrary link between performance and profit. As long as schools assign grades and give promotions based upon work which can be falsified, they will have to accept the added responsibility this places on teachers to monitor and verify student work.

More important, they must accept responsibility for the confused message they may be sending to students. For if the subject matter of the lessons is, indeed, useful, then why should performance have to be goaded by promises or punishments. If, through the implications of their reward structure, schools manage to convince students otherwise, then they have lied to them about the world.

Finally, if schools continue the widespread application of incentives, they must accept the fact that they may be undermining one of their expressed purposes for schooling: the preparation of students for lifelong learning. Schools cannot know what activity a particular student will find interesting and worth pursuing in its own right. Even if this were possible, it would make no sense to give some students incentives for doing an activity because they dislike it, while withholding those same incentives from other students because they like the activity. Schools are bound to administer incentives impartially and dispassionately. In so doing, however, they may be robbing students of the most important reason for learning--their own reason. This personal reason for learning grows out of the student's own "doings, thinkings, sufferings, and receptivities" (Dewey, 1902). It is born of the ecological demands of the learning activity and nurtured in the student's heart and intellect. It is the only purpose for learning which the student is likely to carry with him beyond the school walls. If, as

the present study suggests, the use of contrived rewards in schools interferes with this vital educational purpose, then, in the researcher's opinion, schools are doing students a greater disservice than if they failed to impart some quantifiable body of knowledge.

But there is another course for schools implied in the present research. It is a course that leads away from the need to use contrived incentives. It is a far more difficult course than the first, in that it would entail an extensive restructuring of the schools as we now know them. Such a course would demand that educators find ways to create coherent, responsive, and engaging learning environments; that they build, within the schools, a meaningful world for students to learn about; or, that they find ways to take schooling into the world where students must ultimately apply their knowledge. However, too little is known at present to make such an educational revolution likely. While some educators and schools have made isolated attempts in this direction, an ecological approach to schooling has never been tried on a large scale. Even those who see this approach as a viable alternative to the present school structure have difficulty knowing how to begin.

Much research into the structure of ecological learning systems is needed before practitioners can know how to devise coherent, responsive, and engaging learning environments in schools. Research needs to examine more closely

the process of learning as it occurs in the world. What are the characteristics of real world environments that capture and direct attention? How does the individual preceive coherence within events? How is environmental feedback used by the learner? Another research priority should be the investigation of ecological rewards and how they function. For a given skill, what are the ecologically rewarding consequences associated with its development? Does the novice derive reward from the same sources as the master? If not, what are these different sources of reward and how do they change with skill level? Can ways be found to reveal to the novice what the master sees in the activity? Finally, research should examine the unfoldment of the learning cycle in various settings to discover what factors encourage or inhibit engagement, process, disengagement, and reengagement of learning activities. Ethnographic and anthropological techniques, which are becoming more and more prevalent in educational research, probably offer the best method for conducting such ecological investigations.

Summary

This chapter has presented the researcher's interpretation of the results of the study. In general, the results seem to indicate that students can and do learn in an environment which engages their attention, contains

feedback within activity to specify progress and competence, and makes coherent the structural relationship between acts and the consequences of those acts. Reinforcement for competition increased the amount of and importance placed on competition, and it reduced practice time and engaged time. Moreover, it reduced the likelihood that rewarded children would reengage the activity a week later, when there was no external pressure to do so. Reinforcement for competition did not seriously influence social interactions, nor did it affect measures of skill development. The implications which the researcher has drawn from these results regarding the use of contrived rewards in schools were presented, along with suggestions for future research which might point the way toward an abandonment of contrived reward structures.

APPENDIXES

APPENDIX A

OBSERVATION TOOL

OBSERVATION TOOL

Team ____ Treatment ____ Day ____ Start _____ Finish _____

Subject #1 _____ Familiarity with game _____
Subject #2 _____ Familiarity with game _____

Time of first match _____
Total time for session _____
Engaged time: Subject #1 _____ Subject #2 _____
Reason for disengagement _____

E's Record of Matches:

BOARD/WINNER	BOARD/WINNER	BOARD/WINNER	BOARD/WINNER
1.	6.	11.	16.
2.	7.	12.	17.
3.	8.	13.	18.
4.	9.	14.	19.
5.	10.	15.	20.

Specific Observations:

Instructional Events (nature of instruction, duration and specific evidence of desire to help)

Arguments (nature of argument, resolution, evidence of cooperation or lack of it)

Interference (nature and degree of disruption)

References to Cheating E (exact quote if possible)

OBSERVATION TOOL--(Continued)

Team _____

Record of Social Interactions and Board Use: Code at 50-foot intervals. (Any behavior is coded only once for a given interval, regardless of the number of times it occurs during that interval. Any behavior which is ongoing for more than one interval is recorded once for each interval.)

Interval	VTR Foot	Behavior	Board S#1	Board S#2	Notes
1.		A IE LM C P E INT M N	1 2 3	1 2 3	
2.		A IE LM C P E INT M N	1 2 3	1 2 3	
3.		A IE LM C P E INT M N	1 2 3	1 2 3	
4.		A IE LM C P E INT M N	1 2 3	1 2 3	
5.		A IE LM C P E INT M N	1 2 3	1 2 3	
6.		A IE LM C P E INT M N	1 2 3	1 2 3	
7.		A IE LM C P E INT M N	1 2 3	1 2 3	
8.		A IE LM C P E INT M N	1 2 3	1 2 3	
9.		A IE LM C P E INT M N	1 2 3	1 2 3	
10.		A IE LM C P E INT M N	1 2 3	1 2 3	
11.		A IE LM C P E INT M N	1 2 3	1 2 3	
12.		A IE LM C P E INT M N	1 2 3	1 2 3	
13.		A IE LM C P E INT M N	1 2 3	1 2 3	
14.		A IE LM C P E INT M N	1 2 3	1 2 3	
15.		A IE LM C P E INT M N	1 2 3	1 2 3	
16.		A IE LM C P E INT M N	1 2 3	1 2 3	
17.		A IE LM C P E INT M N	1 2 3	1 2 3	
18.		A IE LM C P E INT M N	1 2 3	1 2 3	
19.		A IE LM C P E INT M N	1 2 3	1 2 3	
20.		A IE LM C P E INT M N	1 2 3	1 2 3	
21.		A IE LM C P E INT M N	1 2 3	1 2 3	
22.		A IE LM C P E INT M N	1 2 3	1 2 3	
23.		A IE LM C P E INT M N	1 2 3	1 2 3	
24.		A IE LM C P E INT M N	1 2 3	1 2 3	
25.		A IE LM C P E INT M N	1 2 3	1 2 3	
26.		A IE LM C P E INT M N	1 2 3	1 2 3	
27.		A IE LM C P E INT M N	1 2 3	1 2 3	
28.		A IE LM C P E INT M N	1 2 3	1 2 3	
29.		A IE LM C P E INT M N	1 2 3	1 2 3	
30.		A IE LM C P E INT M N	1 2 3	1 2 3	

OBSERVATION TOOL--(Continued)

Code for Social Interactions:

"A" Argument over turn, score, rules or techniques of play.

"IE" Instructional Event (coaching or offering advice with the intent improving partner's play).

"LM" Look-at-Me statements (boasting, seeking partner's attention or praise).

"C" Cheating statements (references to cheating, e.g., "You cheated," "That's cheating," "This is how I cheat"; serious accusation would be classified as Argument.

"P" Praise following partner's good play (including applause).

"E" Encouragement following partner's poor play.

"INT" Interference or disruption of partner's play (statements or actions intended to annoy or distract).

"M" Match.

"N" Noninteraction with game by one or both S's (involvement in something other than playing or watching partner play).

APPENDIX B

QUESTIONNAIRE

Team____ Subject _____ Age ____ Grade ____ Treatment _____ Day _____

PLEASE ANSWER EACH QUESTION HONESTLY. IF YOU NEED TO THINK ABOUT AN ANSWER, TAKE YOUR TIME. IF YOU NEED FOR ME TO REPEAT OR EXPLAIN A QUESTION, LET ME KNOW.

1.	Did you enjoy playing Labyrinth?	Yes No
2.	I am going to read five pairs of words. For each pair, pick the one that most nearly describes what playing Labyrinth was like for you.	a. Interesting Boring b. Frustrating Carefree c. Easy Difficult d. Play Work e. Simple Complicated
3.	How would you rate Labyrinth on a scale of 1-10, where 1 means you dislike the game and 10 means you like it very much?	1 2 3 4 5 6 7 8 9 10
4.	Which do you usually like better: games that you play alone or games you play with other people?	Alone With Others
5.	Is Labyrinth more fun when you play it by yourself or when you play it with a partner?	Self Partner
6.	How much skill is involved in playing Labyrinth?	None A Little A Lot
7.	How much luck is involved in playing Labyrinth?	None A Little A Lot
8.	While you were playing Labyrinth, did you every feel angry?	Yes No
9.	(If #8 "Yes") When you felt angry, were you mostly angry with yourself or with the game?	Self Game
10.	(If #8 "Yes") Were you ever angry with your partner?	Yes No

* * * * * * * * * * * * * * * * * * * *

You won _____ match(es). (Circle appropriately)

11.	If you had won more (fewer) matches do you think you would like Labyrinth more (less)?	Yes	No
12.	When you won (lost), was it mainly because you were lucky (unlucky) or because you tried harder (didn't try hard enough)?	Luck	Effort
13.	When you won (lost), was it mainly because you had practiced a lot (hadn't practiced enough) or because the game is easy (hard) for you?	Practice	Game difficulty

* * * * * * * * * * * * * * * * * * * *

14.	Would you be willing to come here and play Labyrinth again after school or on a holiday?	Yes	No	Maybe
15.	If you had to teach someone to play Labyrinth, are there any tips you could give them, to help them play the game better?	_____ _____ _____ _____		

APPENDIX C

POSTEXPERIMENTAL INSTRUMENT

POSTEXPERIMENTAL INSTRUMENT

Team _____ Subject # _____ Name _____ Date _____ Time _____

Reengagement

Duration: _____

Description: _____

Performance

Board #1	Trial	S's Prediction	Actual Score	Best Score	Adjusted Score
	1	Yes No			
	2	Yes No			
	3	Yes No			
	4	Yes No			
	5	Yes No			
Board #2					
	1	Yes No			
	2	Yes No			
	3	Yes No			
	4	Yes No			
	5	Yes No			
Board #3					
	1	Yes No			
	2	Yes No			
	3	Yes No			
	4	Yes No			
	5	Yes No			

APPENDIX D

CORRELATION MATRICES

TABLE A-1

Pearson Correlation Coefficients for Learning Process and Outcome Measures

Variable	Intervals With Matches	Practice Time	Engaged Time	Mean Board Difficulty	Board Variability	Skill Test Scores	Prediction Accuracy	Reengagement
Intervals With Matches	1.00							
Practice Time	-.64	1.00						
Engaged Time	-.65	.60	1.00					
Mean Board Difficulty	-.26	.19	.22	1.00				
Board Variability	.56	-.48	-.60	-.36	1.00			
Skill Test Scores	.34	.75	.20	.37	-.11	1.00		
Prediction Accuracy	.14	-.07	-.05	.11	-.06	.47	1.00	
Reengagement	-.06	-.09	.17	.06	-.20	-.18	-.04	1.00

TABLE A-2

PEARSON CORRELATION COEFFICIENTS FOR QUALITATIVE VARIABLES RELATING TO SOCIAL INTERACTION AND AMOUNT OF PAY RECEIVED

Variable	Arguments	Instructional Events	Look-at-Me Statements	Cheating References	Praise	Encouragement	Interference	Cheating Partner	Minimax	Pay
Arguments	1.00									
Instructional Events	-.17	1.00								
Look-at-Me Statements	-.14	.33	1.00							
Cheating References	.29	.20	.23	1.00						
Praise	-.06	.24	.64	-.05	1.00					
Encouragement	.28	.13	.19	.05	.22	1.00				
Interference	.44	.11	.22	.23	.14	.09	1.00			
Cheating Partner	.08	.07	-.24	-.08	-.24	-.22	.07	1.00		
Minimax	.41	-.10	-.29	.01	-.08	.11	.19	.18	1.00	
Pay	.28	-.24	-.50	.04	-.33	-.28	-.06	.57	.48	1.00

TABLE A-3

Pearson Correlation Coefficients for Attitudes Measured by the Questionnaire

Frustration	Liking	Difficulty	Skill	Competition	Frustration	Internality
Liking	1.00					
Difficulty	-.47	1.00				
Skill	-.37	.35	1.00			
Competition	.19	-.04	-.37	1.00		
Frustration	-.29	.16	.19	-.27	1.00	
Internality	-.14	.41	.30	-.26	.12	1.00

APPENDIX E

"ARGUMENTS ABOUT CHEATING"

TABLE A-4

Means, Standard Deviations, and 2 × 4 Split Plot ANOVA Summary Table for Arguments About Cheating

Condition	Time 1		Time 2	
	$\bar{X}$	S	$\bar{X}$	S
NN	.60	1.34	1.60	1.34
NR	.80	.84	2.40	1.51
RN	2.40	2.07	1.00	1.73
RR	2.20	.45	1.60	1.14

Source	df	SS	MS	F
Condition	3	3.48	1.16	.40
Error	16	46.80	2.93	--
Time	1	.23	.23	.24
Condition*Time	3	14.47	4.82	5.22*
Error	16	14.80	.925	--

Time 1 vs. Time 1	df	SS	MS	F
NN	1	2.50	2.50	2.70
NR	1	6.40	6.40	6.91*
RN	1	4.90	4.90	5.30*
RR	1	.90	.90	.97

Condition	df	SS	MS	F
at Time 1	3	13.00	4.33	4.68*
at Time 2	3	4.95	1.65	1.78

*$p \leq .05$

TABLE A-5

Specific Comparisons for Arguments About Cheating

Comparison	Value of the Contrast	Standard Error
[a]Time 1		
NN + NR vs. RR + RN	-2.60*	.430
Time 2		
No specific comparisons were made; F = 1.78		

*$p \leq .05$

[a]Using Bonferroni t, which controls error rate per family.

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Rita L. Graham was born on September 2, 1949, in Panama City, Florida. She was graduated from Forest Hill High School, West Palm Beach, Florida, in 1967. She was awarded the Florida State Teaching Scholarship and attended Florida State University, from which she graduated in 1971 with a Bachelor of Arts in English Education. In 1972, she earned a Master of Science in Mass Communication, also from Florida State University.

From 1972 until 1977, Ms. Graham was a faculty member in language arts at Vanguard High School, Ocala. During those years, she developed and taught elective courses in mass media and creative writing. Her teaching responsibilities included publication of the school's literary magazine, Excalibur.

In 1977, Ms. Graham began doctoral studies in the field of curriculum and instruction, with a major emphasis in educational media and instructional design. During her studies, she was elected to Phi Delta Kappa and Kappa Delta Pi education honorary societies.

After graduation, Ms. Graham plans to write and consult on the subject of designing motivative learning systems. She

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